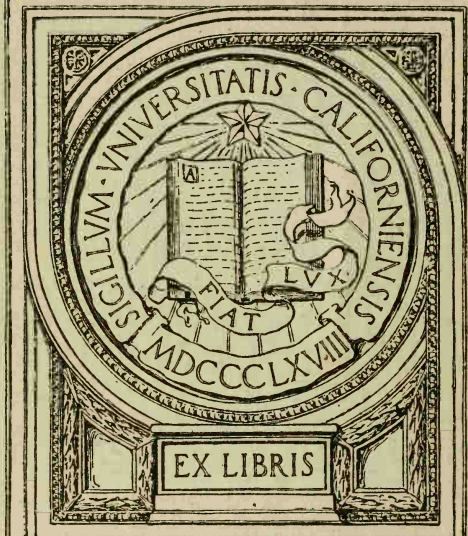
PREVENTION AND TREATMENT OF INFECTIONS



Medical dept.

THE PREVENTION AND TREATMENT OF INFECTIONS

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PREFACE

During the publication in *The Journal of the American Medical Association* of the series of articles entitled "Prevention Greater Than Cure," frequent suggestions were made for their publication in book form. In response to these suggestions, they are now reproduced in this form. The influence of the ordinary factors of life on health, the modern methods for the prevention of disease and the treatment of the commoner disorders, especially those affecting the growing child, are the subjects considered. The aim has been to make this a practical handbook for those interested in the care of the child—the physician, the teacher, the hygienist, the school inspector.

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CHAPTER I

SOME COMMON FACTORS IN IMMUNITY

LIFE PROBLEMS

The "survival of the fittest" begins with the germ of reproduction, goes through embryonic life, through parturition, through infant life, through childhood, and presumably should be considered as ultimately satisfied at 20 years of age, but it is not perfectly satisfied until another individual emanating from this "fit" individual of 20 years or more has also reached the age of 20. Such, theoretically, may be considered the "survival of the fittest."

It is the object of this series of articles to cause medical men to review the knowledge already acquired of the means and methods of causing more "fit" to be born, and more "fit" to survive and have their health unimpaired by preventable disease.

To show how lavishly nature provides at the start for the survival of the fittest, it should be noted that each human male having normal sexual health and living until the age of 60 is said to produce more than 300 billions of spermatozoa, while the ovaries of the human female are said at puberty to contain about 30,000 eggs. This is not to suggest that the world would be happier with an enormous increase of individuals, but it will be happier, and there will be less poverty, if there are more normal individuals and fewer abnormal ones. The economic value of wars and plagues need not be discussed, but it should be remembered that the strongest men (the most "fit") are the ones who die in battle, and that pestilences destroy the "fit" as well as the "unfit."

The great sterilizer of men and women, especially the latter, is gonorrhea; the great abortionist is syphilis. And again, these diseases are likely to be acquired by the "fit" among our men, and, unfortunately, often innocently acquired by the "fit" among our women. Therefore, war, pestilence, gonorrhea and syphilis entail an inferior progeny, and hence economically and socially are deplorable.

Most infectious diseases leave the individual less "fit," although after surviving an acute onslaught of some one or more of these diseases he may acquire an immunity to the germs and to infections in general, and he may even, as years go by, transmit more or less of such immunity to his offspring. Or, on the other hand, he may transmit a susceptibility to certain germs to his offspring. Most severe attacks, and even mild attacks, of infection leave permanent marks on the individual, even though he survive. Hence the great purposes of medical men, to-day, are: (1) to prevent disease; (2) to produce antivaccines that will protect or cause immunity to a disease without so disturbing the organism as to cause permanent lesions or damage to tissues; (3) if an antivaccine cannot be produced, to discover an antitoxin that will rapidly inhibit the infection when it occurs; (4) to advance physiology and chemistry so that the needs of a defective organ may be supplied by the organic extract or chemical stimulant that it needs; (5) to disseminate the knowledge now acquired as to proper hygiene, proper diet and food values, and the methods of acquiring not only infectious diseases but also chronic organic diseases and thus to stave off preventable diseases and postpone diseases due to age.

SLEEP

This is a necessary and not sufficiently discussed part of our daily life. About one-third of each day of an adult's life should be spent in restful, natural sleep. Some individuals require more than others,

but eight hours is the average requirement. Loss of consciousness, not syncope, not coma, not stupefaction by drugs, constitute normal sleep. People who are not mentally alert, who are heavy and stupid or who are mentally insufficient sleep easily. This is true of cretins, of those of low mentality, of the absolutely illiterate (those who have little to think about), and of the very obese (in these cases drowsiness may be due to the amount of blood needed and circulated in the fat). Individuals who are anemic are likely to be sleepy and require more sleep. Children, young children especially, require much more sleep than adults, as their active brains become more readily fatigued.

The conditions favoring normal sleep are probably (1) fatigue products circulating in the brain or causing vasodilatation of the abdominal and peripheral circulation; (2) anemia of the brain more or less relative to that during consciousness, and (3) diminished cerebral reflex stimulation from external stimuli due to the dulling influence of fatigue products on reflex cerebral or spinal irritability, or it may be that such products circulating in the blood dull the senses and the peripheral sense nerves, or both.

During sleep the pulse is slowed and the brain contains less blood, while the other organs of the body contain more blood. The blood-pressure is lowered. The eliminative glands are more active, notably the sweat glands and the kidneys, but the secreting glands are diminished in activity. During sleep cellular repair takes place, final products of metabolism are formed and excretion is promoted.

Normal sleep cannot be produced by hypnotic drugs, although unconsciousness may be caused and the patient made to sleep. Under the action of hypnotics one or many organs do not functionate and cannot normally act, and the resultant sleep is inferior to natural sleep. Perhaps the most normal hypnotic is

that which causes sleep by lowering the blood-pressure and causing anemia of the brain.

High blood-pressure, hysteria, etc., are causes of sleeplessness, and in these and many other conditions sleep must be brought about by physical methods, if possible; or it may be necessary to have recourse to drugs. Absolute insomnia is dangerous and must be stopped, but the continued use of hypnotic drugs invites only disaster, though the temporary use of such drugs may soon promote normal sleep and may actually save life. In fact, not enough thought is given by physicians to the amount of sleep that their patients obtain. Regulation of the sleep should be aimed at by every physician in every case requiring his care.

On the other hand, too much sleep is disastrous; the individual's brain becomes sluggish and incompetent, overpassive congestion of the abdominal organs takes place, sluggish metabolism occurs, constipation, kidney disturbances and a weakened circulation are the results. Patients who complain of being, or whom questioning shows to be, abnormally sleepy are pathologic and need medical advice. Overeating, alcohol, cerebral plethora, obesity, failing circulation and subthyroid secretion may all be causes of sleepiness. The cause being discovered, the treatment is self-evident.

Among the most frequent causes of insomnia are peripheral irritations, mental anxiety and hyperthyroid secretion.

WATER

The amount of water that should be taken is important, and quite generally is neglected by physicians in treating their patients. It is not a physiologic crime or a sign of a beginning pathologic condition to arise once at night to urinate (insurance examination blanks to the contrary notwithstanding), in cases in which the patient drinks a glass or two of water before retiring, which is not an infrequent habit. If the emunctories are to properly work during sleep, water is needed, and it should not be withheld. There is no

intention in the above to minimize the importance of the symptom of arising several times at night to urinate as an indication of high blood-pressure and kidney, bladder or nervous irritability.

Water in plenty is an essential part of the diet at all times, and especially should goodly amounts of it be ordered in most conditions that require medical treatment. It is absurd to allow the "water cures" to do all the ordering of this simple sanitary flushing commodity.

Before all operations, if there is time (that is, if it is not an emergency case), large amounts of water as well as plenty of starchy (carbohydrate) food should be given. After an operation the giving of a colon injection of from one pint to one quart of physiologic saline solution is good practice, and if the patient after operation receives such injection he will have less toxemia, less vomiting, better acting skin and kidneys, less headache and more sleep.

On the other hand, let us decry the thoughtless ordering of large amounts of water, or lithiated or other fool waters, for patients who may be gouty and have defective kidneys, but who also have impaired circulation. An albuminuria from heart or kidney defect rarely calls for large amounts of water. Excessive amounts will weaken the circulation and cause congestion of the kidneys and dropsies.

The best time for taking extra water, that is, besides the normal goodly amount with meals, is three hours after eating. A considerable amount of water taken with a meal does not diminish or slow digestion; neither does a large amount of water taken between meals diminish the hydrochloric acid of the stomach. Hence water increases and does not inhibit gastric efficiency, and it promotes intestinal health. In cases of gastroptosis or gastric dilatation, large amounts of water may increase distress by overburdening the stomach, which does not readily empty itself.

HEAT AND INFANTS

The death-rate from diarrheal diseases is twice as great in summer as in winter. Short-lived high temperature may cause some heat deaths of infants, but does not much affect the death-rate from gastro-intestinal disturbances, unless it should cause an unfavorable turn during an acute attack of the trouble. On the other hand, continued excessive heat does cause an increase in the death-rate from diarrheal diseases in infants, although the heat alone is not the only factor. Germs that cause intestinal disturbances seem to grow better in hot weather, although hot weather, if causing an increased temperature in the child, seems to lower the tolerance to starchy foods.[1]

Hence the prevention of these disturbances and the saving of life will be caused by shady verandas, roof-gardens, trees, parks, seashore resorts and cool evening country air.

Previous knowledge has recently been confirmed[2] that more than one-half of the deaths of children under 1 year of age are due to disorders of nutrition, and about 75 per cent. of these deaths occur during the first three months of life. These statistical facts, together with the disturbances caused by the heat of summer, emphasize the advisability, if not the necessity, of a mother nursing her baby during the first year of its life, as the mother's milk is ordinarily the safest food that the child can receive.

INFANT AND SCHOOL HYGIENE

Success in the work which this heading represents has been shown by the splendid reduction of deaths in young children in cities properly utilizing the knowledge of medical science and sanitation which we now possess. In some cities there has been a diminution of more than two-thirds of the deaths from contagious

1. Zahorsky, J.: Am. Jour. Dis. Child., November, 1913, p. 318.
2. Supplement 16, U. S. Pub. Health Rep., June 19, 1914.

diseases and of more than one-third of the deaths from catarrhal and respiratory diseases of young children.

The foundation of these splendid results, which should be studied and inaugurated in all communities, are: measures for the purification and proper refrigeration of milk; instruction in the proper preparation of milk as a food for infants; the house visits of trained nurses; the babies' aid, and mothers' aid societies; school inspection; school hygiene (good light, aided by the proper color tints of walls and ceilings, proper desks and chairs, rest and exercise periods); play-grounds; open-air schools; segregation of defective from normal children, etc.

It is not the purpose in these articles to discuss in detail these great problems, but only to suggest that those interested, and those who should be interested on account of their official positions, should read and study the statistics already published. It is desired to urge the necessity of careful, skilled school inspection and to urge on school boards that proper light saves eyes; that proper desks and chairs prevent scoliosis and other deformities; that good ventilation prevents respiratory troubles; that clean books, pencils, desks and chairs prevent eye, nose and throat inflammations, to say nothing of the contagious diseases; that proper rest periods save the child's brain from tire; that good, well-paid teachers promote education with a minimum amount of brain fatigue in the child and cause the child to cooperate with, and not combat, the instruction offered. Also, means must be inaugurated to feed underfed children.

The necessity of school inspection is readily shown by quoting Allport's[3] figures, viz.:

There are in public schools in this country 20 million children, and 75 per cent. of these are suffering from some defect that can be cured, or at least ameliorated; 500,000 of

3. Allport: Arch. Pediat., June, 1913.

these children have heart lesions; 1,000,000 have spinal curvature or other defect; 1,000,000 have tuberculosis; 1,000,000 have defective hearing; 5,000,000, or 25 per cent., have defective vision; 5,000,000, or 25 per cent., are underfed or wrongly fed; 6,000,000, about 30 per cent., need operations on the tonsils or adenoids, and 10,000,000, or 50 per cent., have defective teeth.

Skilled school inspection probably reduces the deaths from contagious disease by 50 per cent., and perhaps the total number of contagious-disease cases by 75 or 80 per cent. Also, the improved hygiene of schools and the improvement in health caused by the correction of defects discovered by medical inspection must greatly reduce the instances of contagious disease.

The value of regulated and supervised calisthenic exercises for schoolchildren is great. These should teach correct standing, correct walking, correct breathing and such muscle exercise as will develop all parts of the body symmetrically. Dancing under a skilled teacher is valuable exercise, if not too long continued, or if it does not add one more preventive of the child's enjoying good out-door play and walks.

The dance craze of this age is deplorable. The harm done sexually, neurotically and physically to youth and young adults is terrible to contemplate. The harm done to old men and women is ridiculously unnecessary.

Skilled, corrective muscle exercises to remedy defects in deformed children are necessary to prevent the deformity becoming permanent, and it is a crime to neglect such treatment.

More detailed suggestions for school inspection will be presented later.

AIR

There has been a good deal of misunderstanding as to what constitutes impure air. There is always in the ordinary respired air of buildings and houses too little carbonic acid gas to do any harm to an individ-

ual. Also, a varying content of oxygen, within ordinary limits, is not an important factor in the effect of the air on human beings. It is only heat and extra moisture in confined, respired air that is depressing. Also, stagnant air is more depressing than air in motion, even when it is of the same constituency. Of course, dust-laden air is always injurious. In artificial ventilation in hospitals, schoolrooms and auditoriums screening from outside dust and vacuum-cleaning from inside dust are essential; in fact, stagnant dust is bad and moving dust is worse.

Too great heat is often maintained in winter in schoolrooms and hospital wards, especially in those for children. Also a great variation of day and night temperature in hospital wards is not advisable. While dry air is not necessarily unhealthful, as noted in high altitudes, deserts, plains, etc., still a normally regulated moisture should pervade hospital wards and operating-rooms, which latter are generally too dry, unless steam sterilizers are in use. Schoolrooms not overheated will probably be normally moist from outside air.

One great disadvantage of stagnant, overheated, overmoist air seems to be its effect on the skin. The skin cannot normally breathe, so to speak; moisture remains on its surface, the skin glands cease to properly act, and the surface circulation and heat elimination are interfered with and the person feels depressed, metabolism is impaired, the appetite fails and loss of nutrition occurs. Everyone realizes the refreshment felt when a window is suddenly opened in a stagnant room. Hence the danger to health in a school, factory or store where the air is stagnant, dusty, overmoist or overheated.

The value of the open-air treatment of many diseases has been incontrovertibly demonstrated. Overheated rooms are bad for the sick, and especially bad for sick babies. An infant may have his body tem-

perature raised by a continued sojourn in an overheated room or by being long subjected to summer heat, at 85 F. or over.

BAD HABITS OF CHILDHOOD

It is only necessary here to name some of the habits that are subversive of the future good health of the child. The physician should be alert to these causes of poor health and nervousness in children, and if he is, proper preventive or corrective treatment will be inaugurated. These bad habits that should be watched for are masturbation, thumb- and finger-sucking or sucking the pacifier (said by some eminent pediatrists to promote the development of adenoids), nail biting, imitation movements or habit-spasms and dirt-eating or other objectionable eating habits.

The various local causes of masturbation and of bed-wetting must not be forgotten. The eradication of such causes sometimes cures the condition like magic.

ACUTE ACIDOSIS; AUTOINTOXICATION

Whether a lessened alkalinity of the blood and tissues, or whether an absorption of maldigestive or germ toxins is the first factor in this condition, it seems to be a fact that the subsequent symptoms are largely those of acid intoxication. Any chronic disturbance may promote acute attacks of this condition, such as that due to adenoids; to chronically inflamed tonsils; to chronic appendicitus; to maldigestion of fat; to long privation from carbohydrates or to an insufficient amount of carbohydrate food; to profuse continuous vomiting (starvation acidosis); to imperfect liver function; to chronic pain as a preventive of proper digestion as occurs in ovarian and uterine pain; to severe headache (eye-strain, very frequently), besides the acidosis recognized to occur in kidney disturbances and in diabetes.

All persons are liable to this acid intoxication, as even so-called bilious attacks, sick headaches and

acute indigestions cause this condition. Children frequently suffer from such disturbances.

The primary symptoms are often quite similar to those in the beginning of an acute infection, such as diphtheria, tonsillitis, scarlet fever, or even pneumonia; hence, the immediate diagnosis must be guarded. A history of repeated attacks will aid in the diagnosis. Of all causes, not only in adults, but also in children, among the most frequent is eye-strain, not recognized for a long time as a cause. The most frequently assigned cause is indiscretions in the diet; but though such are often causes, especially in young children, various articles of food are quite frequently unjustly accused. It will often be found that an eye pain or a headache preceded the other symptoms, and that these attacks may follow definite overuse of the eyes, such as looking at moving-pictures, seashore or mountain height eye-strain (that is, long distance vision), or close observation of moving objects, or the addition of long columns of figures, or too much kindergarten work, etc.

The "morning after" nausea and vomiting from overindulgence in alcohol is probably largely an acid intoxication, although small doses of alcohol in the acidosis of diabetes are beneficial when a sufficient amount of starch has not been ingested.

The symptoms of acid poisoning are loss of appetite; coated tongue, or perhaps the tongue may be abnormally red; often nausea and vomiting; constipation; the face is pale, or perhaps flushed; there is headache; generally some fever (not often above 101 F.) in children; the surface of the body is often cold in adults; there may be dizziness in adults and excessive nervous irritability and excitement in children. The skin may show urticaria, erythema, or a punctate rash, or a dark mottling. Some attacks of the above character are really anaphylactic attacks, and may occur repeatedly after certain foods, but others are due to hyperacidity, as evidenced by the

sweet breath and the urinary findings of acetone, diacetic and oxybutyric acid. The excretion of urine is almost invariably diminished, except perhaps in a real migraine attack, and it may show albumin and even casts. The duration of these attacks varies from a day to a week, depending on the character of the exciting cause.

The immediate treatment is the administration of cathartics, alkalies and large amounts of water; high enemas, at first for colon washing and later to introduce physiologic saline and alkalies (such as sodium bicarbonate, sodium citrate and potassium citrate) for absorption into the blood. Stomach washing is often of benefit.

As soon as vomiting ceases, oatmeal gruel or other thin cereal and milk-sugar or glucose should be given. The fruit juices, such as orange and lemon, are of value. Rest, a bland diet, and daily free movements of the bowels and plenty of water taken soon cause a complete return to health.

The preventive treatment is to seek the etiologic factor and eradicate it if possible; if not possible, then to prevent the subjective exciting cause, such as a misuse of the eyes, ill-advised food, too much fat in the food, alcohol, coffee, tea, tobacco, etc. Bad teeth and bad throats must be treated.

BATHING

As a hygienic measure, bathing goes back to most ancient times. Warm and cold water baths, and even medicated baths are mentioned in early Grecian periods. In the middle dark ages, after the Roman period, bathing as a hygienic and therapeutic necessity sems to have been forgotten. Interest in public baths and medicinal bathing and the hygienic popularity of frequent bathing has only within the last thirty or forty years been slowly reviving.

Frequent bathing is essential to remove dirt, sweat and skin excretions. Irritating decomposition and

offensive odors are caused by the neglect of bathing, to say nothing of such neglect causing many skin diseases. Proper bathing increases normal excretions from the skin and promotes the health of the skin. Hot water bathing relieves the congestion of internal organs, improves the general circulation, and cold water bathing tones up the vasomotor system. A normally bathed skin is a better regulator of the internal temperature, a better excretor, and has more normal sensations (heat, cold, esthesia). Soap, hot water and friction are essential to remove dirt and sweat. A simple plunge or shower bath, if taken daily, and followed by rough-towel friction, may keep the skin clean and healthful, but even then a hot soap bath is more or less frequently essential.

The daily cold plunge does not necessarily place a man "next to the Gods," as he so frequently thinks it does. Such cold plungers are often very proud of their accomplishment and sneer at those who do not take this daily treatment, and the plunger is likely to "thank God that he is not like other men." Very many times daily cold plunges or cold showers are harmful, especially to those who are underweight or are losing too much weight. A daily or nearly daily bath of some kind, however, is essential for almost every one in order to promote the best of health and to prevent some diseases.

It is not our purpose to describe, or even to discuss the various kinds of baths, or hydrotherapy. Medicated baths, various sweating baths or so-called baths (electric light or body baking), mud baths, etc., have all their valuable uses, but are not necessary for the promotion of health in the well, that is, are not hygienic measures. The cold bath may be from 80 to 70 F. or below. The tepid bath may be considered anything from 80 to 100 F.; anything much over 100 F. is a hot bath.

Whenever possible, every family should have a set bath tub. Every city should have public as well as

private bath houses and swimming pools, except where the climate is warm the year around and good water for bathing (fresh or salt) is near at hand. Every child should be taught to swim.

The family physician should be consulted as to the kind of bathing each individual should take, and many serious errors would not occur. It is not advisable to bathe directly after a meal. Good fresh air is as essential for bathrooms as for any other part of the house. One respires more while bathing (hot or cold), and hence the air should be pure. Friction is a valuable adjunct to bathing.

The medical value of salt water bathing has been overestimated; it is a pleasure, and it is more exercise, especially in surf bathing and swimming, and thus it is valuable for the well and strong. The cold air at the seashore after the person leaves the water is tonic, but may cause chilling in the weak.

MEAT INSPECTION

This is to urge the necessity for the state employment if skilled meat inspectors for animal food slaughtered for local use. The government inspects only for interstate and export commerce. Besides tuberculous beef, the danger of the human being acquiring tapeworms from cysticercus-infected beef and pork, and the danger from trichinae should be emphasized. It should be known that sheep may also be infected by the cysticercus (from dog infection) though this is not transmitted to man. Swine, at least, are often infected with lung fluke disease. Esthetically, however, it is not pleasant. The danger lurking in ancient cold-storage fowls and turkeys and stale shellfish, and shellfish gathered or fattened in sewerage-polluted water, only emphasizes the need of local food inspectors, backed by bacteriologists employed by local boards of health.

IMMUNITY TO DISEASE CAUSED BY PROPER FOOD

Too much fat in food causes the formation of too many soaps and a loss of calcium from the body through the stools. This leads to acid intoxication, and frequently occurs in infants. While carbohydrates tend to prevent acidosis, too much carbohydrate in children is said to cause a surplus of water in the tissues, and this creates a tendency to acquire disease. Whether or not this suggestion is true, certain it is that a properly mixed diet gives children and adults much better power, apparently, to ward off and fight disease. A milk diet, for instance, too long continued is bad for both child and adult. Young children should receive milk, starch and maltose or lactose, and later more protein, and they are less likely to acquire infection. It is quite probable that the building up of more antibodies by richer protein food may be the reason that in adults the infection of tuberculosis is generally at first local, while in young children the infection is likely to be immediately general.

A well, healthy infant rarely has thrush, while by the sickly infant it is readily acquired.

MOSQUITO PEST

This ubiquitous tormentor may be eradicated and malarial fever abolished in most communities. It is only necessary to remember the following facts, and to act accordingly:

1. Salt water marshes diluted by fresh-water streams breed mosquitoes; kerosene oil will prevent their development.

2. These salt-water mosquitoes do not carry disease.

3. Fresh-water mosquitoes may carry disease (anopheles, malaria; stegomia, yellow fever).

4. Fresh-water mosquitoes may develop in any little pool of water, in the street, in a back yard, in a tin can, in a pail of stagnant water, in a gutter or

drain, and even when water stands in a vessel in a building.

5. Such pools of water being abolished, no mosquitoes can develop.

6. Kerosene, 1 ounce to 15 square feet of water, added from time to time to water that will not readily flow or tends to be stagnant, but cannot be eradicated, will prevent all growth of mosquitoes.

7. Mosquitoes, unless wind-blown, travel only a few hundred yards from their source of breeding.

8. Most disease-breeding mosquitoes are active only at night.

9. Fine mosquito-netting keeps them out of houses.

10. If they have entered a house they can only be thoroughly eradicated by complete fumigation.

11. If one must go to malarial districts, the prophylactic dose of quinin is from 3 to 5 grains a day of the sulphate.

According to Orenstein (The Journal, Jan. 30, 1915, p. 458), numerous studies by many observers have conclusively shown that many species, including such proved disease carriers as *A. albimanus, C. fatigans,* and *A. argyritarsis,* travel very considerably more than "a few hundred yards." Also, at least certain species, and among these the *A. albimanus,* travel by preference *against* a mild breeze, one not exceeding a velocity of 4 miles per hour. The supposition of mosquitoes being "blown by wind," he believes, is open to serious doubt. It is more than likely that they travel during the calm immediately following a blow. In experimental work carried on in Panama, anopheles were invariably caught in larger numbers in the traps set on the lee sides of houses.

A. albimanus and *argyritarsis* breed in salt water under certain conditions. He has found these species breeding very prolifically in lagoons with a chlorin content almost equal to sea water.

He suggests the perusal of Le Prince's paper in the *Transactions* of the Fifteenth International Congress on Hygiene and Demography, and the articles dealing with mosquitoes in the reports of the New Jersey Agricultural Experiment Station.

OPHTHALMIA NEONATORUM

The prevention of this disease, so serious for the babe's future, is not attained by discussing the value of eugenics, or attempting the regulation of prostitutes, or demanding the always non-successful reporting of gonorrheal cases. It will be more certainly secured by insisting that every physician and every midwife (by continued and repeated instruction) shall use Credé's method, namely, to instill into each eye of every new-born babe 2 drops of a 2 per cent. solution of silver nitrate. Every eye inflammation in the new-born or occurring shortly after birth should be considered ophthalmia until the microscope shows that it is an innocent inflammation. If gonococci are found, the little patient should be placed in the care of a skilled oculist.

TONSILS

The danger from chronically diseased tonsils is not sufficiently recognized by the majority of physicians, although specialists and bacteriologists have long urged that they are a menace to health and should be extirpated. Some laryngologists, and they have a goodly number of internists as followers, would extirpate (enucleate) all tonsils that have the least signs of chronic inflammation, especially if they are even slightly enlarged.

Before advising radical operation, that is, enucleation, it should be remembered that these glands probably have a function as outposts of our fortifications against disease germs, and when they are extirpated or are hopelessly diseased the deeper neck and bronchial glands become more readily affected by patho-

genic germs. It should be remembered that complete enucleation is a major and serious operation. With the above caution, the therapeutic necessity of eradicating all diseased tissue in a tonsil by slicing, curetting, cauterizing, or, if need be, complete enucleation, is strongly urged. Also, as a measure of disease prevention, to eradicate tonsils containing infected pockets is more necessary than to pull or fill a decayed tooth.

It should be recognized that a tonsil may be badly diseased and yet not be prominent. Also, disease may proceed from a tonsil and yet there may be no immediate preceding tonsillar inflammation.

It has been shown that pathogenic germs, as pneumococci and various streptococci, especially hemolytic streptococci, may be harbored in diseased tonsils. These germs have been found so many times in acute and chronic arthritis and acute and chronic endocarditis, and in other infections, as to show a direct causation.

The surface bacteria may not give the cultures that the deeper-seated pockets or abscesses in the tonsils produce. Hence, in rheumatic cases, before the tonsils are considered innocent, whether a tonsillitis precedes the rheumatic attack or not, a careful examination of the tonsils should be made.

Infected tonsils may be the cause of influenza, chorea, nephritis, endocarditis, and various pyemic and septic processes, as well as of rheumatism. In fact, all and more than has been said of infected gums and teeth may be said of the danger of chronic suppuration in tonsils. The relation of tuberculosis to the tonsils has long been known. It is quite supposable that anemia, meningitis and neuritis could emanate from infected tonsils as well as from infected gums. While all diplococci found on tonsils are not pneumococci, the latter are found often enough to show that they could be a cause of pneumonia through the infection of others, if not in the carrier. Diph-

theria, follicular tonsillitis, and, doubtless, scarlet fever, are caused by infection from carriers who have the causative germs of these diseases on or in their tonsils.

To summarize:

1. The total extirpation of non-suppurative tonsils is not necessary.

2. The extirpation of all diseased parts, or total extirpation, if it is necessary to eradicate the diseased portions, is proper treatment and advisable as soon as discovered.

3. Operative interference is therapeutically urgent in all cases of recurrent tonsillitis, in rheumatic cases, acute or chronic (arthritis deformans), in nephritis, etc., if the tonsils are found diseased.

PREVENTION OF CONTAGION

Before disease can be prevented its source and its method of transmission must be known. This is too large a subject to treat here, but a brief summary of our present knowledge and of the objects aimed at will be of interest.

To the greater part of the United States, cholera, yellow fever, bubonic plague, some so-called malarial fevers, some dysenteries, and some other diseases, are practically foreign. The cholera bacillus reaches us in ships, and quarantine and governmental control takes this dread disease out of the hands of the individual practitioner. Suffice it to say that stool and urine disinfection, screening against flies, and boiling and using superheated plates and eating utensils, a supply of clean drinking-water and eating with clean hands are the key notes to the prevention of the infection of others. The prevention of dysentery and typhoid fever, both due to known germs, is not dissimilar. Yellow fever infects us by means of contaminated mosquitoes; hence, every case is a menace unless absolutely screened from these insects. The

same is true of malarial fever. Bubonic plague is dispersed by the bite of fleas from infected rats. Governmental control of this disease when it entered San Francisco rapidly eradicated it by destroying the infected rats.

Typhus fever is spread by infected body-lice and at times by head-lice. Brill's disease is a form of typhus. The necessity of scrubbing and absolutely cleaning all places of close confinement and all individuals who are confined or about to be confined therein is self-evident.

It has long been known that certain diseases are contagious and transmitted from person to person, but it is only within recent years that the actual germs of disease have been discovered, and still more recently that in some instances the exact method of infection has been discovered. Formerly the contagious element was supposed to be carried in clothing, baggage, money, rags, etc., and to cause the disease when the innocent individual came in contact with such infected materials. In the case of scarlet fever it has until recently been believed that the desquamating skin, the epidermal scales, carried the infection. It has now been pretty thoroughly demonstrated that such is not the fact, that the infection of scarlet fever comes from discharges and secretions of the mucous membranes of the nose and throat and from ears that are suppurating from this disease.

It has been long known that the eruption of measles does not carry the contagion, but that the contagion is transmitted by means of the nose and throat secretions.

Theoretically, dirty money, especially paper currency, handled by all kinds of people and by people suffering from or in close contact with contagious diseases, should transmit disease; but it has not been found to do so. Bank men and treasury department men who handle large amounts of gold and dirty money do not contract disease. This does not excuse

the disgusting practice of putting coins in the mouth, or of wetting the fingers with the tongue in counting bills. Certainly, every individual who handles money should frequently wash his hands, especially before eating, and before handling food for the use of others.

Many kinds of bacteria have been found on stairways, balustrades, car straps and on money, but generally such bacteria have been found to be non-pathogenic. Such negative findings, however, and the lack of demonstration that disease is frequently transmitted by such methods, do not controvert the possibility that occasionally infection may be transmitted from one infected person directly to another by immediate contamination of some article. This possibility only emphasizes the necessity for the more or less strict isolation of infections, and the strict observance by an infected individual of the rules and regulations for the prevention of infection of others which are prescribed for the particular disease that he has.

The greatest factor in the spread of infection in any community or in any associated group is the germ carrier; and the more innocent the individual is of the fact that he is a carrier of pathogenic organisms, the greater the danger to the people who surround him. Therefore, in every epidemic, carriers should be sought for and when discovered should be isolated and treated. Also, a patient recovering from a contagious disease should be proved not to be a carrier before he is dismissed from quarantine or isolation. Another great source of the infection of others is by mild cases of infection in which the individual is not sufficiently ill to remain in the house. Also, some of the children's infections are transmitted in such early stages that the child is not supposed to be ill, or at least is not supposed to have a contagious disease. This is notably true of measles.

Since it has been determined that direct contagion is almost a universal method of transmission of many of the contagious diseases, and that clothing and baggage are rarely, if ever, agents of such transmission, it is evident that some of the measures which have hitherto been employed to diminish the danger of contagion have been of little or no value. Fumigation of rooms, apartments, houses and buildings by various chemicals, is, in most cases, a waste of time, energy and money. It having been determined that most of the contagious diseases are transmitted by secretions from the nose and throat or mucous membranes, or are eliminated with the excretions, cleansing, and perhaps in some instances antiseptic nose and mouth sprays and gargles, and the immediate destruction, either by chemicals or by heat, of all germs that leave the body either by the urine, feces or mucous discharges, and the cleansing with antiseptics of all objects in contact with or in the immediate region of the infected patient, are all sufficient to prevent contagion. All discharges from the noses and throats of patients who are ill from almost any cause should be received into cheesecloth or paper napkins, and these should be immediately placed in a paper bag which should be burned.

Many antiseptic or disinfectant solutions used for the stools and urine are not satisfactory. Bed-pans or other vessels used for receiving the excretions should be cleansed with boiling water or steam. The urine should be received into a vessel which contains a strong antiseptic, as a chlorinated-lime solution 5 per cent., or mercuric chlorid solution 1 : 500. The urine should then stand in this covered vessel for an hour or more before it is thrown down the closet. The same solution may be used to receive the fecal matters, at least in all diseases in which the feces carry infection; but it is here necessary for the fecal deposits to be broken up, that the germicidal fluid may act on all parts. Chlorinated lime may well be added to the

mixture, an equal volume of a 25 per cent. mixture, and the whole tightly closed and allowed to stand for two hours or more before it is permitted to pass into the sewer. While boiling these excretions is the surest and most complete way of killing all germs and spores, in private families this would be a disagreeable and inconvenient method. In hospitals efficient steam or boiling measures for sterilizing all excreta should be installed. All possibly contaminated articles of clothing, bedding, rugs, carpets, etc., should be subjected to heat or steam, if such cannot be actually boiled. All other objects in the room may be well cleansed by washing or scrubbing with formaldehyd or mercuric chlorid solutions. Fumigation of the rooms with sulphur and formaldehyd, if not useless, is not sufficient.

EFFECT OF SEASONS ON HEALTH

A positive indication of the effect of this factor on public health can be obtained by the death-rate in the registration areas for the different months of the year. Many studies of these statistics have been made, and it seems to be a fact that the greatest mortality usually occurs in the month of March, although sometimes January surpasses March in mortality, and February follows closely. In July and August, also, the death-rate is somewhat higher than in the immediately preceding and succeeding months, while the minimum death-rate generally occurs in June, and November is usually the month of next lowest mortality. These statistical facts are not surprising, as it has long been recognized that the highest mortality occurs in the months characterized by extremes of temperature, the hot weather of July and August causing a large mortality among children, while the cold weather of January and February causes a high death-rate from diseases of the respiratory system. Many old people and many feeble persons who may have combated and survived the sever-

ity of January and February are quite likely to succumb in March. Also the relaxation of a little warmer weather causing more or less carelessness among the well makes March the month of the greatest number of deaths.

Besides the morbidity and mortality associated with these extremes of temperature of summer and winter, various other factors must be taken into account. Such are local climatic conditions, as peculiarly unhealthy weather may prevail in a region, at any season, and cause the death-rate to be abnormal for that season. Persistent and recurrent rain or snow, dark days, or excessive humidity may so depress individuals that they become more susceptible to disease; and the ill do not so readily recover as when the weather is pleasant. Epidemics of various kinds may, of course, also increase the death-rate at any season.

While it is the sick, the weak, the old, and the very young who are especially likely to suffer from excessive heat or severe cold, even the strong and the robust are affected by climatic severities, and a larger proportion of the well become ill, especially with the intense heat of summer.

To prevent illness in hot summer weather, persons should not unnecessarily expose themselves to the rays of the sun, and should especially avoid severe exercise in the heat when it is not necessary. This is a special warning for those who take hard exercise, in vacation recreations or amusements, in the sun in the middle of the day. Such persons, also, are often not used to such exposures, their work being mostly indoors.

The air in cities is likely to be more dust-laden and more impure in hot weather than in cold weather, as however well the streets are watered, the dust on houses and buildings and in crevices more readily dries sufficiently to be wafted by the least breeze. Also decomposition of all animal matters occurs more rapidly and more readily contaminates the air. Con-

sequently, because of the heat and this air impurity, all those who are able leave the city and seek the seashore or the country. Such changes of location are not always a panacea, as, if such individuals are compelled to lose all their home comforts, if they must sleep in small, ill-ventilated rooms and in crowded quarters, if they are pestered with mosquitoes and their food is covered with flies, as obtains in so many summer boarding houses, and if the seafood presented is not immediately from the water or properly refrigerated, the harm done is greater than the good. Many things should be considered by the individual or the family and by the family's physician before the summer abode is changed. This is not to minimize the great advantage of vacations and of fresh, clean, seashore and country air, provided other dangers are not incurred. Also, the danger of overdoing seashore bathing must not be forgotten.

For the many individuals or families who cannot leave their homes, or to whom it seems unwise to do so, the summer may be rendered more comfortable by properly screening the windows and doors from flies and mosquitoes and still allowing free circulation of air, screening of verandas or balconies, if such is advisable, resting as much as possible during the interim from labors, and not taking severe and uncomfortable trips or amusements to add to the exhaustion caused by the work that must be done. Many persons come back from excursions or trips, after buffeting with the crowds, more exhausted than when they left. The trolley trip should be selected that gives the greatest amount of fresh air with the least amount of crowding and exertion. Cool bathing should be advised and urged as a most splendid method of lowering the temperature, cleansing the skin from perspiration and causing it to become more active and thus lowering the internal temperature. Of course excess of such bathing should be avoided

Before leaving this subject of summer heat, let it be urged once more that over-eating, late hours, and strenuosity in vacation and summer amusements should be abolished, and that the prime thing is restfulness in the coolest, cleanest air that can be obtained.

Men are not careful enough to wear thin clothing and protective, air-cooled hats. In this era nothing need be said of the air-cooled clothing of the women for summer. Certainly from a physiologic and sanitary, if not a moral point of view, their clothing seems unassailable.

As to the opposite climatic extreme, namely, the severe cold of winter, it is equally important that the strong as well as the weak should not subject themselves to needless exposure. The strong are likely to boast that they do not need overcoats or other means of protecting themselves from the cold. Many such individuals fall by the wayside, needlessly. The underclothing should be that found best for the individual; whether linen mesh, silk (if one can afford it) or thin woolen, is a matter for individualization, modified by the region in which one lives, and the work which one does. Whether an individual wears overcoats or sweaters is a personal decision, but the wearing of sweaters all day, at work or in buildings, is a serious mistake, which is made frequently by young men. The feet should be warm, the kind of shoe depending on the weather. High shoes should be worn in cold weather and rubbers when it is wet, unless the shoes are water-proof. If a child wears rubber boots for storm and play, in wet and snowy weather, he should not be allowed to sit with them on in school. Rubber heels are always good; rubber soles are a serious mistake, especially in summer, and for one to be insulated with these heavy rubber-bottom shoes for hours, or all day, is an abomination. Such rubber insulation causes the feet to perspire, and causes a lack of tone of the feet.

The costume and clothing of men in winter does not require a great deal of discussion. The clothing of women and girls, projected from the summer into the winter, is a proposition that it is practically hopeless and needless to discuss. They wear furs draped around them almost anywhere; the warmth of the rest of their costume is indeterminable. We venture to state that the physician of to-day rarely feels more helpless than when one of these girls comes to his office with a severe cold and cough. He knows that it is more care and common sense that cures a cold than drugs, and without the two former elements in the cure he is forced to rely on drugs in which he has but little faith. Any common-sense advice that he will give such a girl will either place him in disfavor, or will be received and not acted on. It might be parenthetically stated that what is said above also generally applies to the girl's mother.

The clothing of young children in cold weather is more often incorrect than correct. Many are overclothed; many are under-clothed. The family physician should carefully advise in this important matter.

Those who habitually live or work in warm rooms should be careful to wear clothing of moderate weight so as not to be overheated while in the house, but they must put on overcoats or cloaks on going out. In the northern and eastern parts of the United States people are very likely to have their houses overheated in winter. A temperature ranging from 68 to 72 F. with an adequate amount of fresh air is the temperature that is the most healthful. Old people and very young children require and must have greater heat than this in winter. The best heating system for houses and buildings need not here be discussed.

Individuals who can afford it, and who are weak and feel the cold severely, or who suffer more or less from bronchitis, colds, or other disturbances due to cold weather, should go to a warmer region during the winter. If they go to the southern United States,

however, they must go far enough south to get the warmth, and not into the middle south where it is not very warm, and where the houses are not as well heated as their own homes. They should go at least below South Carolina in the East, and in the West, to Southern California, Arizona, or New Mexico. Many people who can afford this climatic luxury return to their homes too early in the spring, and are more likely to acquire severe colds, and even pneumonia, than though they had remained at home all winter. Also, it must not be considered that these regions are exempt from the possibility of severe chilling and from pneumonia. Many an individual has gone to a warmer climate and acquired pneumonia, and died of it.

DUST

We have already briefly referred to what is now understood as pure air, and the effect of stagnant and overmoist air on the individual. The injury caused by dust or impure air, however, has not been sufficiently emphasized.

The excellent discussion of this subject two years ago by Prof. Charles Baskerville of the College of the City of New York[4] has been used as a basis for this article.

For practical purposes the impurities of the air may be divided into two classes, dust, and fumes or gases. In the cities the dust contains pulverized excreta of human beings and animals, the material which is constantly being worn from the buildings and pavements, the waste from houses, stores and factories, micro-organisms, leaves, remains of fruit, and other parts of plants and trees. It is interesting to know that the air of subways contains many minute angular particles of iron.

In the country the dust consists to a larger extent of particles worn from the road. The substances of

4. Baskerville, Charles: New York Med. Jour., Nov. 23, 1912, p. 1061 and Nov. 30, 1912, p. 1119.

which the road is composed are more or less pulverized by the traffic. This dust is especially increased by heavy carts and automobiles. The country roads are disintegrated in part by the frosts of winter, in part by the wind, by the action of the falling rain, and by the transporting power of water. Oiled roads, as soon as they dry, give rise to particles of crude, irritant tar-oil which are wafted with the dust.

These components of the dust are all more or less irritating, not only to the mucous membrane of the respiratory tract, but also to the eyes. When the amount of dust is small the irritation may be slight, but when the amount of dust is large and when there is a considerable amount of tar-oil present, the irritation may be very troublesome.

The prevention of this dust is accomplished by care in the building and in the maintenance of the roads. The best structure for a roadbed and top dressing must be decided by the region, by the variations in climate, by the geography of the locality, and by the character of the traffic. There is doubtless no one best roadbed.

There is no question of the necessity for a city to water its streets. There, also, seems to be no question of the advantage of oiling turnpikes and country roads, if they are built of material that allows of oiling. Whether or not a city should oil its streets is a subject for discussion.

Baskerville suggests as a suitable disinfectant and agent for the diminution of dust a very dilute chlorinated lime solution. The chemical is cheap, and any outlay entailed would be more than covered by the decrease in dust-borne diseases. He also calls attention to Dr. Nesbit's work in ridding Wilmington, N. C., of flies by sprinkling the streets five times with an attenuated mixture of water with light pine-oil. An incidental effect of the suppression of the flies was the stamping out of a typhoid fever epidemic.

The other part of the impure air problem has to do with noxious fumes and gases, and is especially important in cities. There may be mentioned first the danger from illuminating gas. The chief poisonous constituents of this are "ammonia, hydrocyanic acid, hydrogen sulphid, carbon disulphid, other gaseous sulphur compounds, and carbon monoxid." The danger from the inhalation of concentrated illuminating gas, such as is often taken with suicidal intent, are too well known to require repetition, but the hygienic importance of good ventilation and the constant renewal of outside fresh air to a room where illuminating gas is constantly, or for a long time, burning is not sufficiently understood. Also, the depressing influence and the actual blood disturbances, even anemia, caused by the constant inhalation of the gas from an illuminating-gas leak in a house or building is not sufficiently noted, and is not investigated by boards of health as it should be. Leaks of illuminating gas, which occur so constantly and frequently in tenement houses, stores and factories, have not been sufficiently considered as a menace to health.

The atmosphere outdoors in manufacturing towns is contaminated extensively with the smoke produced by the combustion of large quantities of coal. The combustion gases from this source are of a highly poisonous nature. They may be diminished to a considerable extent by proper management of the fires by skilled firemen. An important constituent of this smoke is the soot, which is due to incomplete combustion, and which may be "formed partly by the mechanical removal of dust by the chimney draft, and partly by the decomposition of the fuel, such as takes place in the process of destructive distillation. It consists mainly of carbon, tar and ash or mineral matter together with small amounts of sulphur and nitrogen compounds, and often possesses an acid character." The sticky properties of soot are due to the tar which it contains.

Sulphur dioxid is one of the most important impurities of city air, especially in manufacturing towns, and this is derived to a large extent from the combustion of coal and of coal gas. Its presence in the air has a serious effect on susceptible persons, and particularly damages the respiratory organs. It tends to cause anemia and bronchitis. Various efforts are made to discourage the dissemination of smoke in communities. It has been suggested that more might be accomplished if the matter were placed by municipalities and boards of health "in the hands of men qualified to assist manufacturers to suppress the nuisance without causing them difficulty." Methods have been invented whereby much of this waste combustible material may be collected with profit to the manufacturer and with health and happiness to the surrounding community. The smoke nuisance should be most seriously considered by all cities.

The dust which is present in the air of many shops and factories, and which is produced incidentally to the various processes employed in the mechanical arts, is a factor of considerable importance in connection with the health of the workmen.

These dusts may be divided into three classes: (1) insoluble inorganic dusts; (2) soluble inorganic dusts, and (3) organic dusts.

The first class, the insoluble inorganic dusts, includes metals such as antimony, arsenic, type metal, brass, bronze, copper, aluminum, iron, steel, lead, manganese, silver, tin and zinc, in a state of fine division; also various ore dusts such as that from iron ore, silica, sand, emery, flint, glass powder, carbon, graphite, diamond, coal, soot, brick dust, marble, granite, cement, terra cotta, lime, gypsum and plaster.

The second class, the soluble inorganic dusts, includes substances which may be swallowed and absorbed, such as metallic particles like lead, brass, zinc, arsenic, mercury and silver, and soluble inorganic salts.

The third class, or organic dusts, includes "sawdust, fur, skins, feathers, broom and straw, grains and flours, jute, flax, hemp, cotton, wool, carpet dust, street sweepings, tobacco and tobacco-box dust, hides and leather, felts, rags, paper, horsehair, etc."

These various dusts affect chiefly the respiratory organs, but to a less extent the eyes and the skin. In the lungs they produce a condition of fibrosis of the lung to which Zenker gave the name "pneumonokoniosis." Various forms of this disease have been described, depending on the nature of the irritant producing the fibrosis. Among them may be mentioned anthracosis, or coal-miners' disease, caused by the inhalation of the dust from anthracite coal; siderosis, caused by the inhalation of the dust from metals, especially from iron, and chalicosis, caused by the inhalation of mineral dusts, resulting in the so-called stone-cutters' phthisis and grinders' phthisis. The inhalation of iron dust diminishes the respiratory efficiency of the lungs by causing a lessening of their elastic property. It may also reduce the resistance of the lungs to invasion by harmful bacteria. That form of disease distinguished as siderosis exists with special frequency among metal polishers, knife grinders and others engaged in metal work.

Among the diseases caused by the organic dusts may be mentioned flax dressers' disease, a kind of pneumonia due to the inhalation of particles of flax and alkaloidal poisoning from African boxwood, seen in workmen engaged in shuttle making.

The prevention of these various forms of disease incidental to various forms of industry without unduly interfering with the profits of the business is often an exceedingly difficult problem. Among the suggestions which have been made, and which are employed with more or less advantage may be mentioned:

1. The removing of the dust from the room in which it is produced by forcible suction applied at the

seat of its production. This is especially applicable in the trades of grinding and polishing.

2. When irritating dust affects the eyes, glasses for their protection should be worn by the workmen.

3. Those engaged in sorting rags in paper factories, workmen on threshing machines, millers, mixers in glass factories, stone cutters, sculptors and all others in factories where there is irritating dust should wear respirators over the mouth and nose to prevent the dust from entering the respiratory organs.

4. Those employed in the manufacturing of oxidizing agents or lead workers should change their clothes before leaving the factory.

5. The dust on the floors of printing, type-casting, metal-working and similar establishments should be laid by means of certain preparations adapted for this purpose. Probably the best are mineral oils which accomplish this result very satisfactorily.

6. General ventilation of the shop should be employed as far as practicable to dilute the unavoidable dust and remove it as far as possible.

7. The value of vacuum cleaning for factories should be emphasized as much as it is for office buildings, stores and private houses.

THE COLON BACILLUS

We harbor, more or less normally, some germs that may become pathogenic, notably the colon bacillus. The part this germ plays in causing acute inflammation or chronic disintegration of organs is variously stated, but it seems ever ready to attack us when our armies of protection are reduced in number or otherwise engaged. It has been suggested that this germ or its toxins may be a cause of neurasthenia, arteriosclerosis and chronic nephritis, if not of liver disturbances and cerebral disturbances. It has been shown to cause appendicitis, cholecystitis, and perhaps pyelitis. It is thought by some to be a cause of the ever-

frequent duodenal and gastric ulcers. It may play an important part in the pernicious anemias, which are now thought to be generally due to an infection. Not infrequently, in acute disease, complications occur which are attributable to the colon bacillus or its toxins. Often some chronic catarrh has been shown to be complicated, if not caused, by infection with the colon bacillus.

Whether there are other normal bacilli in the human body that under certain conditions may become pathogenic has not been discovered, but certain it is that in the prevention of disease we must take into consideration not only the infective but the putrefactive power of the colon bacillus. The prevention of putrefaction in the intestines will promote the immediate health of the individual and may prevent or postpone future organic disease.

Not to discuss the treatment of localized infection from colon bacilli, it may be stated that the treatment of intestinal putrefaction is, unfortunately, unsatisfactory. The prevention of constipation, withholding meat, including fish and poultry, from the diet, the administration of lactic acid bacilli as such or as soured milk, or the administration of yeast, and the cure of any gastro-intestinal inflammation that may be present by proper dietary, medicinal or surgical treatment, may prove very successful for some years in staying or preventing intestinal putrefaction. Although later to be discussed, it may be here urged that healthy teeth and gums are essential factors in the cure of intestinal fermentation.

C. E. A. Wilson (Jour. Med. Research, Vol. X, No. 3, p. 463) states that the colon bacillus is found on the hands of 5 to 10 per cent. of people examined, showing how careless this proportion of individuals are. The fact that colon bacilli have been found on hands carries with it the probability that typhoid bacilli may be carried and may contaminate food or other articles in this way.

MINE SANITATION

While this subject is not of much general importance, it is of great importance to some of us, and should interest all. New methods of saving life and of avoiding accidents, and the condemnation of criminal carelessness should ever be subjects worthy of careful review, if not of individual study.

Mine problems, so well understood by some physicians, but so little by the majority, are splendidly outlined in an article by Dr. N. P. Brooks[5] which it would be well for all interested to read carefully. The main points for consideration are proper and scientific ventilation, proper lighting methods, methods to diminish dust, proper drainage, proper disposal of excreta of men and animals, and a greater care of the personal hygiene of the miners.

Briefly, the gases in coal mines are as follows:

CH_4, methane or marsh gas, is "colorless, odorless, tasteless, lighter than air, in a pure state burns with a blue flame, and is very explosive when mixed with certain proportions of air." When breathed in a pure state it affects the individual not unlike laughing gas, and does not cause harm when inhaled as long as the supply of oxygen is sufficient.

CO, white-damp or carbon monoxid, "is a colorless, odorless, tasteless gas, lighter than air, combustible, and explosive when mixed with a certain proportion of air." This gas is very poisonous, and if 1 per cent. of it is breathed for any length of time it produces dyspnea, headache, loss of sight, soon paralysis, beginning with the lower extremities, and finally unconsciousness. When unconsciousness is caused by carbon monoxid the patient may not be resuscitated at all, or if he is, his mentality may be seriously injured. A positive indication that this gas is accumulating in dangerous amount is shown by the death of white mice or other small animals, that should be kept in the

5. Brooks, N. P.: Month. Cyc. and Med. Bull., April, 1913, p. 203.

mines where their condition can be readily observed by the miners.

CO_2, carbonic acid gas, carbon dioxid, "is a colorless, odorless, tasteless gas, heavier than air, and a non-supporter of combustion." The presence of this gas in abnormal amount is readily detected by the dimness of the oil lamps. The first symptoms of a poisonous amount of this gas are increased heart action, lassitude, and headache. If the amount of the gas is very considerable the individual may fall unconscious without even a cry. Men subjected to this poisoning may remain unconscious for some hours, provided they get a sufficient amount of oxygen, and still be resuscitated. "Suffocation ensues when there is 1 volume of this gas to 12 volumes of air."

H_2S, hydrogen sulphid, stink-damp, does not frequently occur in mines, but is very poisonous. Its obnoxious odor causes it to be quickly detected.

Lighting, ventilation and methods of diminishing dust are too technical to be discussed here. Carelessness in the drainage of mines, from the effect that bad drainage can have on the miners, should not be tolerated. Miners who must work all day with wet feet are certainly rendered liable to colds, joint affections and neuritis, if not to more serious illnesses. If they are barefooted, in certain regions, they are liable to acquire the hookworm disease. If they work in rubber boots, the sweating and general lack of elasticity caused by standing all day in rubber is a distinct disadvantage to the individual.

The care of the excreta in mines should certainly be under the control of the boards of health in the regions in which the mines are located, and sanitary measures, now well understood, should be established in every mine. The clothing and cleanliness of the miners and their drinking habits should all be subject to careful supervision, the two former for their individual welfare, and the latter not only for their own

welfare but for that of others, as carelessness is an important factor in mine disasters.

As first aid to the injured in accidents and mine disasters must frequently be rendered by fellow miners or their foremen, instruction should be given to all in artificial respiration, in methods of stopping hemorrhage, in the first antisepsis and dressing of injuries, and in the action of the different poisonous gases. Foremen should pass an examination on such subjects.

EUGENICS

This very large social, economic, medical, religious and legal subject should receive a passing thought in this series on preventive medicine.

Briefly, heredity and environment are the two factors that are most prominent in the production of physical and mental health. Environment may improve or mar heredity, but cannot change it. Heredity is therefore the most important factor in raising and developing an ideal race. Scientific selection in breeding animals and plants has proved its value beyond all possible refutation. The importance of good environment for the perpetuation of physical and mental health is so well understood that it requires no discussion. But environment will not eliminate a hereditary tendency to disease or to mental or physical insufficiency. Neither will environment develop perfect mental and physical health when there is an inherited deficiency, although environment can markedly improve deficiency caused by injury or acquired by disease.

The long gestation, still longer nursing, and yet longer helpless period of the human embryo and human infant demand the long nourishing care of the mother by the father and by the community. This means that for at least two years the father must provide food, protection and comfort, if not luxury, for the mother and child as well as for himself. If he fails in this duty, some other person, some charity,

or the community must assume the duty. This being the fact, worthless, incapable and mentally or physically diseased fathers are a tax on the community.

All kinds of beautiful and necessary charities are succeeding in their aim to raise to adult life defective children, as well as to save the well and strong. A large number of these mentally, physically, and often through heredity, morally defective persons assert the right to marry, and do so, and another crop of defective children is the result. Our orphan asylums, hospitals, sanatoriums, homes, insane asylums, jails and prisons are being overfilled in consequence of the foregoing conditions. What are we going to do about it?

The environment of prospective fathers and mothers and their future children is being constantly improved by the public health advances now being made in all communities, but as has been stated, this will not prevent the ravages of inherited disease (syphilis, epilepsy, insanity, imbecility, physical weakness) or of the inherited tendency to disease (tuberculosis, cancer, gout, diabetes, alcoholism, etc.), any more than environment can produce twins, beauty, geniuses or permanent health. In fact, improved environment is doing more for the defectives in all lines than for those of good heredity, who would survive a less improved environment.

The question for discussion, then, in this one on eugenics is, who shall marry, and who shall have children? It seems doubtful whether the law or the state can, in the present status of the human age and of civilization, enforce scientific selection or compel complete physical and mental examination of a man and woman before they may be allowed to marry. Public health and welfare education, medical teaching and instruction, and the higher education emanating from the church may, in a few decades, make this problem one that is readily decided by the families of the contracting parties, or even by the young man and young

woman most deeply interested. On the other hand, it is possible that the age is ripe for an insistence that known defectives and known diseased individuals be allowed to marry only when the other member of the contracting parties is made cognizant of the fact, and also that means be taken to prevent offspring from such alliances. Such defectives often breed readily and lavishly, and their progeny are often no comfort to themselves, and are more than likely to become a future, if not an immediate, tax on the community and state. This brings up the question of either prohibiting marriages of defectives (known to be such through public charities or public institutions and hence not ascertained by the compulsory examination of private individuals), or of legal sterilization of such defectives.

CHAPTER II

VACCINE PREVENTION AND VACCINE THERAPY

A brief survey of what has already been accomplished shows that small-pox may be prevented, and that typhoid fever and paratyphoid fever may be prevented by vaccines. Streptococcic and staphylococcic infections may be prevented by vaccines, and perhaps pneumonia and erysipelas may soon be aborted, if not prevented, by vaccination.

Vaccines will often aid in the cure of chronic tuberculosis, of gonorrheal complications, of septic infections, of erysipelas, and some cases of rheumatism, and will delay some tumor growths. Vaccine therapy, at times, seems to aid in curing typhoid fever, paratyphoid fever, and pneumonia.

Antiserum cures diphtheria and cerebrospinal fever, and we trust some serum will soon be found for the cure of anterior poliomyelitis. Serum developed from the blood of syphilitics who have received injections of arsenic seems to be therapeutically valuable when introduced into the spinal canal of syphilitics suffering from central nervous-system complications.

It is a well-known pathologic fact that properly to combat a local infection by the blood-serum and in order that the necessary amount of detoxicating antibodies may form, the region about the infection must become congested, that is, the blood-flow, though perhaps decreased in rapidity must be increased in amount. Hence, it has been suggested that before the administration of vaccines in chronic localized infections or suppurations, means should be taken, physically or by drugs, to cause hyperemia of the

part or parts affected. For instance, if the infection is in the skin or near the surface of the body, arsenic or thyroid may be given, or body heat, body-baking, hot baths, or hot applications may be used. If the circulation is sluggish in an inflamed mucous membrane in the nose, throat, or bronchial tubes, ammonium chlorid or digitalis might greatly benefit the action of the vaccines.

SMALL-POX

Vaccination as a protection against this serious disease has been long confirmed by history. Germany, the most effectively protected country in the world against small-pox, compels vaccination at the age of 1 year, and again at the age of 12. With a population of sixty-five millions in 1913 there were only seven cases of small-pox and no deaths.

Some careful observations on vaccinations against small-pox have been made by Force[1] which it is well to review.

One good method is to cleanse the arm or leg with ether or alcohol, then to remove the epidermis in three small spots, by some such scarifier as a dental scaling chisel, by rotary motion, as recommended by Force. He scarifies each spot about 2 mm. in diameter, then applies a drop of glycerinated virus thinly spread. The amount carried on the broad tip of a sterilized wooden tooth-pick is sufficient for the three spots. When this glycerinated virus has dried he covers it with a layer of gauze held by narrow strips of adhesive plaster, not allowing the adhesive plaster to pass over the treated areas. The patient is told to return in five days, and the areas involved being small, no bad arm could develop. No ointments or antiseptic dressings are allowed. If soreness develops, an alcoholic wet dressing is used, one part of alcohol to two parts of water (or even half and half), and soon the

1. Force, John Nivison: An Investigation of the Causes of Failure in Cow-Pox Vaccination, The Journal A. M. A., May 9, 1914, p. 1466.

inflammation will subside. On the tenth day antibodies should arrest the growth of the vaccine organisms and immunity should be established.

Cross scarification is said to be prohibited in Germany, as it is said "to favor the growth of anaerobic bacteria," and deep, unsightly scars are the result (Force).

A good take is shown in five days by "a yellowish vesicle surrounded by a narrow red areola." This is vaccinia, or a primary take, while a vaccinoid or secondary take shows in five days "a smaller vesicle surrounded by a wider areola." "When no vesicle develops and the areola appears and subsides early, it is an immediate reaction, first described by Jenner as 'sudden efflorescence.'"

If a revaccination is made in a person with a seven-year-old, or older, scar, he may be vaccinated in two spots with a control spot inoculated with glycerin *only*. "If either of the two vaccinated spots showed an areola of 5 mm. or over (with or without a papule) at the end of twenty-four hours, which areola (or papule) had decreased after seventy-two hours following vaccination (observations after each twenty-four hours) it was considered a *reaction of immunity*. . . . If either of the vaccinated spots showed an areola at the end of twenty-four hours which developed into a small vesicle, maturing on the fifth or sixth day and then rapidly subsiding, the reaction was considered a *vaccinoid*. If there was no change until the third day and then a small areola began to form, the case would be vaccinia." A small number of unvaccinated persons with no history of small-pox showed the reaction of immunity in this investigation by Force. Force and his co-workers believe that in these cases of apparent immunity without scar, previous vaccinations had been unsuccessful so far as typical sore and subsequent scar is concerned, but sufficiently successful to cause subsequent immunity.

If there is no reaction of any kind, Force thinks that the vaccine used is inert.

The caution is given to observe daily the vaccinated area in all doubtful cases, as immunity reactions are soon over, and revaccination may be done unnecessarily.

The question of the vaccination pustule is worthy of careful consideration. Dyer[2] states that the vaccine vesicle is just as much an indication of vaccinia as the hard chancre is that a patient has syphilis. He also states that the vaccination injury should stop at the vesicle, that the pustule is only a sign of a local infection, and hence should be prevented. Therefore, he advises breaking the vesicle and treating the vesicular lesion antiseptically, and suppuration will thus be prevented. Such a method prevents glandular enlargements, erythemas and other eruptions.

Dyer also urges, as soon as the vaccine vesicle has healed, revaccination to ascertain if the patient is thoroughly protected, and he would revaccinate as long as a vesicle will form, and would not wait a number of years before such a trial. He believes a patient thus treated is positively protected against small-pox.

VACCINATION AGAINST TYPHOID FEVER

The importance of the prevention of this disease is self-evident when it is stated that about 500,000 people are attacked by it and more than 35,000 deaths occur from it annually. Of these about 150,000 cases occur and about 25,000 die of it annually in the United States. The economic loss from expenses due to illness and to the loss of productive lives is simply enormous, and is stated by economists to represent, in the United States alone, a financial loss of about 300 million dollars a year.

The usual mortality of typhoid fever is about 10 per cent., while the protection from the recurrence of

2. Dyer: Am. Jour. Trop. Dis. and Prev. Med., 1913, 1, 447.

typhoid, the patient having once survived it, is represented by more than 95 per cent.; that is, less than 5 per cent. of persons attacked have a recurrence.

The most frequent cause of typhoid fever is infected water and infected milk. Washing uncooked vegetables and fruit with infected water may also more or less frequently cause the disease. As long ago as 1894 it was shown that oysters could become contaminated with water which received infected sewage, and when served uncooked could cause typhoid fever. The culpability of oysters under such conditions has been shown frequently, although some bacteriologic investigations indicate that the pathogenic bacteria from the human intestinal canal are rarely found in oysters. It has been demonstrated beyond controversy, however, that oysters fattened in fresh-water polluted streams may harbor pathogenic germs and, when served uncooked, transmit them to the human being. As it has been shown that oysters do not feed much in cold weather, the danger from their contamination in the cold months is less than in the warm months. Also, the danger of oysters becoming infected has been diminished by the decree by most boards of health that oysters must not be deposited in fresh water for fattening or in water near the shore that readily becomes contaminated with sewage.

For a long time it was not satisfactorily proved that round clams could become infected with typhoid bacilli. Hence the "little necks" have long been eaten raw by those who refused to eat raw oysters. It has been shown lately, however, that round clams may be suspiciously contaminated with sewage germs, although no positive decision that cases of typhoid have emanated from eating such raw clams is known. Long, soft-shelled clams are almost invariably eaten cooked, hence the danger of contamination from such shellfish is at a minimum.

Another source of danger from typhoid fever is that due to flies. These may carry on their feet typhoid

as well as other germs and deposit them on foodstuffs in markets, in kitchens, and on the dining table. Consequently, flies are a serious menace to the health of a community. Possibly the greatest number of cases of typhoid fever occur in the early fall months because this is directly after the greatest fly period. Ninety-five per cent. of flies are born in manure heaps; therefore the most important method of exterminating the fly pest is to prevent their growth in manure heaps. The United States Department of Agriculture, in *Bulletin 118* states that a small amount of borax sprinkled daily on horse manure will prevent flies from breeding.

Borax should also be sprinkled over garbage (especially when not intended for feeding to pigs), over all refuse heaps and open toilets, and it may be sprinkled on the floors of markets. While borax will not kill the grown fly, it will prevent fly eggs from hatching. The cost of borax in Washington is between 5 and 6 cents per pound in 100 pound lots, and it is estimated that it would cost only 1 cent a day per horse for the borax treatment of stables.

Contaminated dust may infect food, and may occasionally be a cause of this disease.

Although the germ of typhoid fever always emanates from the discharges of persons sick with the disease, the danger from carriers who may for years continue to produce the living germs must never be forgotten. Therefore, every sewage system and every privy vault is open to suspicion. The water at seashores, or even fresh water not protected from contamination, should not be swallowed or taken into the mouth by bathers. Sanitary privies should be rapidly introduced, and when this is not immediately possible, means of killing the germs in human fecal matter should be constantly used. All toilets and privies should be screened from flies, and any stable or barn where milk is handled should be under suspicion if the place is dirty, dusty, and fly-infested. All foods should

be under suspicion if exposed to dust and flies. The purification of water-supplies is a question for state and municipal boards of health, and failure on their part to supply to all communities pure, clean water is open to the criticism of negligence and incompetency. Great improvement, however, is being made in many communities in these respects.

In 1893, Fränkel first published his observations on the inoculation treatment of typhoid fever. In 1896, Wright published his first article on antityphoid inoculation. The British first introduced inoculation in the Indian army for the prevention of typhoid fever and demonstrated that the individual was protected by such inoculation for two and one-half years, and partially immunized for five years. In 1900, inoculation prevention was used by Germany, also, in her armies, and German and English military camps soon became almost free from typhoid fever by such protective vaccination.

The danger to an army from typhoid fever, especially during war times, when it is encamped in regions not previously equipped to care for large numbers of men in a sanitary manner, is well shown by the statement that one-fifth of the soldiers in a national encampment of our men in the Spanish-American war had typhoid fever, the actual figures being that out of 107,973 men, 20,728 had typhoid fever, of which number 1,580 died. It is also stated that in 90 per cent. of the volunteer regiments the disease broke out within eight weeks after going into camp.

In spite of all sanitary measures possible, typhoid fever will prevail until the preventive vaccination is inaugurated. With the inauguration of this measure in the United States Army typhoid fever became greatly diminished in frequency. Vaccination of our army was begun in 1909, and, in 1911, among 80,000 men only 11 cases of typhoid fever occurred, with one death. In 1912 there were 15 cases in the army, with 2 deaths. This shows that occasionally the typhoid

inoculation does not protect, but the improvement shown by the diminution in the number of typhoid cases from 9.43 cases out of every thousand soldiers in 1901, to 0.26 for every thousand soldiers, in 1912, compels belief in its efficiency. The death-rate from this disease decreased, per thousand soldiers from 0.64 in 1901 to 0.03 in 1912.[3]

The incubation period of typhoid fever is about two weeks. Its duration, when there are no relapses, is about two months. This means two weeks of incubation, four weeks of more or less serious illness, and two weeks before the real convalescence. Young adults and youth are most likely to contract this disease, although it may occur at any age. This is the age, then, for the greatest effort to be made to give protective inoculations. All nurses and members of hospital staffs; students of colleges and seminaries; employees, and those who are interned in work houses, jails, prisons and asylums; men in lumber camps; and all those who travel and are therefore subjected to varying water, milk and food-supplies, such as "traveling" men, engineers, seamen, tourists, and vacationists, should receive typhoid preventive vaccination.

While it has been asserted that immunity is more positively conferred for a long period by vaccination with living bacteria (protection being similar to that produced by an attack of typhoid fever) still it is generally considered safest and best to vaccinate with dead bacteria. The vaccine slowly stimulates the production of antibodies, that is, in from five to eleven days, with an average of eight days. Some time later there is an increase in the opsonins and agglutinins. The blood generally shows the Widal reaction after the third inoculation. One case was found negative.[4]

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3. Russell, F. F.: House of Representatives Document 1404, Feb. 19, 1913.

4. Maverick, Augustus: Typhoid Vaccination and the Widal Reaction, The Journal A. M. A., June 1, 1912, p. 1672.

Though it has been denied, it seems to be a fact that typhoid vaccine can cause a reaction similar to tuberculin in those infected with tuberculosis.

It has been shown that there is a skin typhoid reaction test similar to the von Pirquet tuberculosis skin test. Gay and Force found this test positive in 20 cases out of 21 (95 per cent.) patients who had recovered from typhoid fever. The same test was negative in 85 per cent. of 41 cases who had not had typhoid fever. This method may become valuable as a test for the continuation of typhoid immunity after typhoid inoculation.[5]

With all the advantages to an individual and to a community conferred by protection against typhoid fever by vaccination, the physician must also carefully consider what constitutes contra-indications. It seems to be wise carefully to examine every individual to ascertain his condition of health before vaccination is done. It should not be done if he is suffering from any acute infection however simple, namely, a coryza, a pharyngitis, a tonsillitis, or any acute gastro-intestinal disturbance, gonorrhea, syphilis, albuminuria, glycosuria, or the more serious conditions of chronic nephritis or diabetes. The injections should be made in the afternoon, and the active symptoms will generally be gone by noon of the next day. Three injections should be given at weekly intervals.

There is a systemic reaction in about 7 per cent. of the cases, most frequently after the second dose, next in frequency after the first dose, and least frequently after the third injection. The temperature reaction varies, with an average of about 100 F., associated with malaise, rarely diarrhea and some nervousness and sleeplessness. Sometimes erythemas occur, and occasionally a herpes of the lips. Generally all active symptoms have disappeared in forty-eight hours. Every person inoculated with this vaccine should

5. The technic of this test will be found in Arch, Int. Med., March 15, 1914, p. 473.

avoid alcohol and all stimulants, should not eat meat, should keep out of the sun, and should not take much exercise. While in the army the vaccinated men were allowed to do ordinary work, in private practice it is inadvisable to allow any exercise during a real reaction. If there is no reaction, the inoculated individual may do ordinary work on the following day.

It has been shown that paratyphoid fever may also be prevented by vaccination with the paratyphoid germs. It seems wise, therefore, in vaccinating against typhoid, to vaccinate with the combined vaccine of typhoid and paratyphoid. The ordinary adult doses for injection are as follows: The first dose may contain 500 millions of the killed typhoid bacilli, 250 millions of the killed "A" paratyphoid bacilli, and 250 millions of the killed "B" paratyphoid bacilli. The ordinary second dose is double this number of dead bacteria, respectively (1,000 millions of killed typhoid bacilli, 500 millions of killed "A" and 500 millions of killed "B" paratyphoid bacilli). The third injection represents the same number of killed bacilli as the second injection.

The method of injection is as follows: Paint with tincture of iodin an area about 15 mm. in diameter at the insertion of the deltoid muscle. Inject subcutaneously with sterile needles and the best vaccine the dose of killed bacteria decided on. Then paint the region with collodion and allow it to dry. If proper care is taken, no infection will occur, and, as above stated, a temperature reaction is rarely above 100 F., and perhaps never reaches as much as 102 F., even in exceptional instances. A severe reaction could only occur when there is some serious complication in the individual, as perhaps tuberculosis. All slight reactions are generally over in twelve hours and even severe ones are generally over in twenty-four hours.

The local reaction is greatest after the first dose, less after the second, and least after the third. Typically, there is an acutely inflamed area, varying

in size, not hard and indurated like an incipient abscess. The arm may ache, and the axillary glands may become tender. The local reaction is generally at its height in about ten hours, and generally nearly gone in twenty-four hours. Any more severe reaction would be due to contamination.

The dosage for children should be based on the child's weight and not on its age. The recommended adult dose is based on a weight of 150 pounds. It seems to be necessary for continued protection to revaccinate children more frequently than adults, namely in about three years. The skin test above referred to may become a means of ascertaining whether, or not, the individual is still protected. It should be remembered that almost one-third of all typhoid deaths occur in persons under 20 years of age.

Typhoid vaccination as a treatment during the course of typhoid fever has not been much used. The theory against such vaccination is that it has seemed unwise, in any disease, to vaccinate and to stimulate an acute process, it being considered that the individual is utilizing all of his combative powers in fighting the infection that he already has. We must note, however, that cases are beginning to be placed on record in which it seems that relapses are prevented and that post-typhoid complications such as typhoid infection of the ears, kidneys, gall-bladder, etc., may be prevented by the judicious use of an antityphoid vaccine. Hospitals, which are the best prepared to carefully watch and judge of the advantages conferred by these injections, should investigate this subject. Until statistics are available, it may be well not to inject these bacilli until such time as the patient is shown to be a typhoid carrier. It is stated that stock vaccines in these instances are as valuable in preventing relapses as are autogenous vaccines.

About 4 per cent. of typhoid-cured patients become chronic carriers. As above urged, a most serious danger to any community is a typhoid carrier, and

unfortunately it is difficult to discover such. As prevention is here also greater than cure, it is a question for the board of health to decide when a typhoid patient shall be released from quarantine, that is, allowed to deposit his urinary and fecal excretions in the sewers or privies without disinfection. Also a carrier may contaminate his hands with living typhoid bacilli, and thus spread the disease. This probably means that the feces and urine should be repeatedly examined by the board of health until typhoid bacilli are found to be absent. This would be a difficult problem, and would interfere more or less with individual freedom, but from an economic standpoint it would be the most money, health and life-saving work that a board of health could inaugurate.

A chronic typhoid bacillus carrier having been discovered (and such are only discovered by the attending physicians, hospitals, and boards of health being ever alert), he or she should be isolated and treated. Hexamethylenamin may cure a kidney infected with typhoid germs. Typhoid bacilli vaccines seem to offer the most successful treatment of these typhoid carriers. Whether they are best treated with stock vaccines or with autogenous vaccines is yet to be determined. Also, the frequency with which such cases are cured is not yet decided. If operative interference would remove the infection, it should be advised. This is especially true in cases in which either the gall-bladder or the ear is the suspected source of infection.

CHAPTER III

THE SCHOOL QUESTION

The following are a few suggestions of important subjects that medical men should impress privately on their families and publicly in their communities:

1. A child should be healthy before it goes to school (adenoids, tonsils, teeth, anemia, debility, etc.).

2. The kindergarten methods of teaching should be investigated, as some parts of this teaching are objectionable, and especially should the eyes of these young children not be overtaxed.

3. The best age for a child to attend a kindergarten is from 4 to 6 years; but the ordinary child at 6 years of age is too young to enter real school work. It would be ideal, from a physical point of view, if the child could then have one year, or in some instances two, in a "play school," combining physical exercise with moral and mental development. Then the child would be well fitted to attend real school.

4. The location of school buildings is important, and the architecture and equipment of such buildings are very important.

5. There should be well-equipped playgrounds in all cities.

6. The books, pencils and other school paraphernalia should be antiseptically cleaned, and clean aprons could well be provided for dirty kindergarten children.

7. Teachers should be mentally efficient, and should be physically examined at regular intervals as to their health. A physically and mentally "fit" teacher is essential for good school work.

8. Open air or open-window schools, and luncheons for underfed children should be inaugurated.

9. Kissing and the exchange of pencils and penholders among children should be discouraged.

10. There should be a trained nurse attached to each large school.

11. There must be medical inspection, if not medical examinations.

12. There should be segregation for feeble-minded, as well as for otherwise defective children. Anemic children, and those with a tuberculous tendency should be in open air rooms.

13. Night schools should have medical and sanitary supervision, especially if such schools are held in the rooms occupied by the children in the daytime.

14. The crime of child labor should be prevented.

SCHOOLHOUSES

The location of the city school cannot always be carefully selected; the school must be placed where it is most needed. The country school, however, should be located high and dry, and with a careful consideration of its sanitation, that is, its water-supply and the proper management of its sewerage system.

There is no excuse for having a country school more than two stories, and if possible, a city school should be but two stories high. The frequent going up and down of long flights of stairs is especially bad for growing girls. The light should be sufficient, and should not shine directly into the pupils' eyes, but should best enter the room from the left and the rear. The blackboards should be so placed as to receive the best light. The temperature should be from 65 to 68 F. Moisture should be sufficient, but not excessive.

The desks and chairs should be very carefully selected, and one or both should be adjustable as to height. Even with such adjustment the children

should not be kept too long sitting, but should have walking, or simple calisthenic exercises to stimulate the circulation and ease the muscles.

The floors should be hard finished, so that they may be readily cleaned with vacuum cleaners, and the furniture should be such that it can be readily cleansed with antiseptics, when such are needed. In fact, daily washing of the floors with some antiseptic may be advisable. The toilet and washing arrangements should be of the best, and sanitary drinking facilities should be installed in every school.

Some one or more rooms should be arranged as open-window rooms. Every large school should have a private examining room for the use of the examining physician and the trained nurse. Every school, if possible, should have a properly equipped playground.

HOURS IN SCHOOL

The kindergarten is undoubtedly good for children whose mothers cannot care for them and who otherwise would be on the street, but the kindergarten teaching is often bad for children who are already pushed mentally in their own homes. We are not sufficiently careful to prevent mental fatigue in schoolchildren, and the number of hours generally devoted to school work is much too great. R. O. Clock[1] has studied this subject, and makes suggestions which should be carefully considered. He believes that from 7 to 8 years of age two hours of actual school mental work is sufficient; from 8 to 9, two and one-half hours; from 9 to 10, three hours; from 10 to 12, four hours; from 12 to 14, five hours. The longer periods should, of course, be broken up into two sessions. At all ages the sessions should be interrupted with from fifteen to thirty minutes' recess for fresh air and relaxation. It has been ascertained that a child at 6 has brain fatigue and his attention tires

1. Clock, R. O.: Dietet. and Hyg. Gaz., September, 1912.

after fifteen minutes of concentration; from 7 to 10, after twenty minutes of concentration; from 10 to 12, after twenty-five minutes of severe work; and from 12 to 16 after thirty minutes. The best brain work has been found to be accomplished in the morning, and fatigue is more rapid in the afternoon, and more rapid when there are bad air and dark or overheated rooms. The brain activity is increased after gentle muscle exercise; hence the advantages of calisthenics and recesses.

It is little less than a crime to spur on brain work without proper exercise and outdoor play, and some pupils, little more than children, are stimulated to mental overactivity and to attain high standing without regard to whether or not they have time for fresh air. Before the age of 12 years a child should not be required to study at home. The crime of pushing children forward, rushing their advance from one grade to another, should cease. The child should advance by natural ability and natural progress. Cramming and pushing to get a certain amount into his brain at a certain date, and then to get him out of his grade into another to make room for one who is being pushed and crammed in the grade below should be abolished.

OUTDOOR EXERCISE

Playgrounds, and regular hours for their use, and the occasional presence and direction of games or exercises by a physical instructor, all work for the great good of the future sturdy citizen.

Weak children should not be allowed to play or exercise to exhaustion. Also, even with strong children, the necessity for bodily repair by rest periods should be urged. The story of nutrition, metabolism and elimination of waste products, and the repair during rest should be understood by all teachers. The bedtime hour for children of different ages should be taught by the teachers.

Competitive physical, and even mental tests or stunts are bad, very bad for some. It is always injurious for growing boys and girls to sustain long physical strain, and it should not be allowed by school boards in schoolchildren. This does not mean that under proper jurisdiction there should not be baseball games for boys and basketball games for girls, etc., but competitive stunts, as just stated, should not be allowed. Secret societies which cause jealousies and cliques and ill feelings should not be allowed, although certain open, non-secret societies whose membership is reached by good work and whose object is to accomplish good work are often excellent training.

PHYSICAL EXAMINATION AND PHYSICAL EXERCISE

When it is remembered that there are twenty million pupils in the public schools, large percentages (as previously stated) being defective in some form or other, it will not be surprising that the following recommendations for the physical examination of children, as distinct from medical inspection which will be discussed later, is urged. These recommendations seem more or less ideal, but they will come to be the rule, if not the law, nevertheless.

If it is agreed, as advanced by some thoughtful educators and physicians, that from the age of 6 to 8 the time should be devoted to physical culture directed by the public schools, and that book work should not begin until the age of 8, just what would be the method of procedure?

First, no sick child should be allowed in the public schools, whatever the age, and sick children should be immediately sent home to the care of their parents. Every child on entering the public school, we will say at the age of 6, should be carefully examined by a skilled physician. This is more than "medical inspection," which only seeks for contagious or transmittable diseases. The record of each child should be kept on a large card suitable for filing alphabetically.

One side of the card should be filled out by the teacher with such data as name, residence, age, sex, nationality, height, weight; condition of parents (living or dead, and health), brothers and sisters (number and health); what diseases the child has had, besides a record of fits, headaches, asthma, hay fever, bilious attacks or attacks of abdominal pain (information on these subjects should be obtained from the parents by the teacher); the number of rooms in the tenement or house of the family, the number of windows in the sleeping room of the child, the number of persons sleeping in this room; and the kind of food and drink the child receives (question of coffee, tea, etc.).

On the reverse side of this card the physician should note the condition of the hearing, the eyesight and the teeth; defects in the palate; condition of the tonsils, question of adenoids, mouth breathing, condition of the nose, and of the glands of the neck; the shape of the chest and abdomen; any defects of the spine, legs and feet; and the condition of the lungs, heart and abdominal organs. If there is bed-wetting it should be recorded, and in such cases the condition of the prepuce noted by the physician, or the condition of the clitoris noted by the trained nurse. If there is suspicion of kidney disturbance the urine should be examined. If the child appears anemic the blood should be examined. A general statement of the state of health and nutrition, and the condition of the skin should be noted; also the medical opinion of the development of the child up to the present time. The disposition of the case should also be stated, that is, what advice was given. The card should be carefully dated. Subsequent examinations should be on a separate card, which should be clamped to the original.

The results of the foregoing examination should determine the proper treatment, if any treatment is needed, and should determine the instructions that should be given the parents as to the need of seeking

the advice of their family physician or of consulting a specialist. Also, the outcome of this examination would disclose the need, or not, of special physical exercises to correct beginning deformities. All children deemed able should then be taught by a physical teacher the physical culture exercises deemed wise for children of this age; one hour a day of various exercises under instruction as classes, and another hour in the school playground. The physical teacher should devote two or more hours a day teaching and treating children with physical defects.

All of this requires money, but to what better object could public money be devoted than to building up the physique of our children and to prevent future defectives and future disease?

At 8 years of age the child is physically and mentally ready for regular school work (not too many hours, or too much home study, as previously cautioned). Such children on growing up keep the habit of exercise, thus acquired, to their benefit, as they will live in the age of labor-saving devices and work that requires but little muscular effort.

Bad home food and bad home and house hygiene would be corrected as far as possible by the visiting nurse, who can be the trained nurse attached to each large public school. Again, all this costs money and seems ideal, but such an outlay would pay the community good dividends on the investment by raising healthy citizens and in preventing disease. Some of this cost could be offset by not appointing so many teachers of things that are not essential and devoting more time to the groundwork of education.

To repeat, it should be urged to push only the essential studies, and curtail or cut out non-essentials and trimmings. Later, both boys and girls, but the latter especially, should be instructed in bacteriology and physiology and hygiene. Much valuable information may be given by the picture method of illustrating the causes of disease, etc.

It is not advised to pauperize the people by developing or using too many unneeded free dispensaries. *Let all parents, unless they are positively unable, take their defective children to physicians, surgeons and dentists of their own selection.* Of course provision must be made for those children whose parents cannot pay for such services; but let the visiting nurse make this decision.

As the children grow older they should be taught how to walk, and dancing exercises of the supervised type might be a part of the physical culture.

When the child is 8 years of age and begins the regular school work, its mental condition should be noted, unless it has been previously declared "feeble-minded." Those who are "feeble-minded" should be segregated and taught separately from the bright children, and an entirely different course and entirely different future plans of educational work should be outlined for such children, distinct from the regular course of instruction for the normal children.

It is an economic mistake not to separate mentally defective children from normal children. Three years ago it was estimated that there were three million children in the United States repeating a school grade a second, third, or even a fourth time at a cost of a hundred million dollars annually to the country, a needless and wasteful expense.[2] It is declared that the mental capacity of an idiot at any age does not exceed that of a child of 2 years; that of an imbecile of any age does not exceed that of a normal child of 8; and that of a feeble-minded person of any age may range from the normal mental capacity of a child from 8 to 13, but never exceeds the 13-year limit. These figures emphasize the necessity of the segregation of feeble-minded children, and also the crime of punishing for indifference or delinquency these children, who are doing all they can do.

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2. Report of Committee on Medical Inspection of Schools, THE JOURNAL A. M. A., Nov. 25, 1911, p. 1753.

The frequency of the physical examinations must, of course, depend on the findings in each case. Defective children should be examined, at least as to the condition of the defect first found, once in three, six or twelve months, depending on the kind of defect. The results, for instance in adenoid or anemic children, should be certified to by the trained nurse on the reverse side of the child's card; that is, whether or not operation has been done in the one case, or whether the child is improved or otherwise in the other case, the child, supposedly, being under the care of the family surgeon or physician.

All of this is paternalism, but only thus is the good of the greatest number accomplished, and no person should be allowed to cause himself to become a tax on the community, to spread disease, or to break well-known laws of health and hygiene.

As the child grows older, as suggested above, he should be taught general hygiene, the laws of contagion, and the ordinary methods of communicating each disease, and simple rules of prevention. Simple anatomy and simple physiology, and the simplest kind of life problems should be taught in public schools. Sex hygiene should not be taught to mixed classes or much in mixed schools. The girls, at or before maturing age, should be instructed in such hygiene individually, not in classes, by the trained nurse. The boys may be talked to by the principal of the school in small groups confidentially, not from the platform.

It is necessary to urge the foregoing physical examination because of the twenty million children attending public schools in the United States only about two-fifths have more or less efficient school inspection and only a very few have medical examinations, and the muscle strength and physical development of our people is said to be deteriorating.

It should be urged that good able physical instructors must be obtained, or serious mistakes are liable to be made. After 10 years of age it is very doubt-

ful if the games and exercises played or taken by boys should be as strenuous for girls; but it has been shown by some careful observers that girls are not harmed by ordinary exercises while menstruating. In fact, it is a serious error for a girl or her mother to believe that she must be an invalid for one or two days every time she menstruates, and a young ladies' seminary that puts each girl to bed for a day at each menstrual epoch does a serious mental injury to the girls. On the other hand, it is not advisable to cause these growing, maturing girls to climb stairs all day in a schoolhouse.

Chronically nervous children, and certainly the epileptics, should be sent home until cured (if cure is possible), or given an entirely different kind of schooling, away from large numbers and the shame caused by the publicity of their defects. Open-window or outdoor schools with small numbers of pupils and individual teaching, and scientific medical psychopathic decision of the best management to overcome such nervous defects as stage fright, stammering, weeping, brain storms, etc., should be the course followed with such children. The regular teachers, underpaid and overworked, should not be made responsible for the instruction or welfare of these children.

The only treatment for developed chorea is rest in bed; if the case is not severe, open air treatment in the country or at the seashore is essential, best where it is warm, and where the child can be under the care of one well-balanced person. Books, and playing with other children should generally not be allowed. Parenthetically, it might be mentioned that rheumatic germs should be suspected, and all disease from tonsils, adenoids, teeth and gums eradicated.

Mental fatigue (with good judgment as to hours of confinement and study and of intermittent play and exercise periods) should rarely occur, except in the nervous or neuropathic or otherwise diseased child.

Precociousness and the morbid desire to overstudy is a sign of mental unhealth, and such children should be restricted in their book work and be compelled to do more physical work. If such management is not successful, they should be treated as psychopathic and as nervous children.

It may be briefly suggested here that adenoids, which are so frequent in young children, tend to shrink by the age of 14 or 15; but the teacher may readily observe, without medical examination, that a child is a mouth breather, looks dull and stupid, that there is beginning deafness, that the speech is imperfect, and that the chest expansion is incomplete. Mouth breathing interferes with the growth of the face and nose.

About 1 per cent. of children have discharging ears, and such ears may carry infection. Hence both for the child's sake and for the sake of others a discharging ear should be treated by an expert.

Eye-strain is of frequent occurrence in children, and headaches, granular lids, twitching of the lid muscles, and disturbances due to imperfect eyesight should be ever watched for by the teacher. Much absence from school, much loss of appetite, much nervousness, and much inability to study properly and advance are due to eye defects, a large proportion of which may be corrected.

MEDICAL INSPECTION OF SCHOOLCHILDREN

The importance of this subject is evident when it is estimated that 70 per cent. of deaths in the United States are due to contagion, that the vast majority of such contagion originates in schools and that, annually, about 11,000 die of scarlet fever, about 10,000 of whooping-cough, and about 9,000 of measles.

Some considerations in the prevention of disease acquired in school are as follows:

It is estimated that each pupil should have 15 square feet of floor space and 200 cubic feet of air

space. Each schoolroom should be about 30 feet long, 25 feet wide, and 13 feet high, and should accommodate not more than fifty children. Allport states that the temperature should be about 68 F., and the humidity between 60 and 70. The thermometer should hang where it will tell the truth, and the best region with this object in view is on a bracket on the inner wall about 4 feet from the floor.

The sanitary measures require proper plumbing, proper drinking facilities, proper towels, sterilization of pencils, books, etc., and antiseptic cleaning of schoolrooms. Safety requires good fire escapes and fire drills.

Medical inspection was started systematically in Belgium, and is now being gradually adopted by many of the European countries and by a large number of the cities of the United States. Perhaps more than 500 of our cities now require medical inspection. Such inspection has been shown to be a necessity and not a luxury. It has been shown that contagious diseases are more prevalent during the months when schools are in session than when there is vacation; therefore if civic and state governments compel the attendance of children at school, they are bound not to subject the pupils to an increased danger of disease and death. Hence medical inspection should be required by state laws, and about half of the states have already passed such laws. It should not be left to the petty decision of towns or cities, although the larger cities have long been pioneers in this work.

This article will not attempt to deal with the question of salaries or the best method of managing the work cooperatively with the boards of health and school boards. The medical inspectors should be selected for their ability and interest in such work, and should be paid adequately. Also, they should not be subject to removal by political changes, if their work is satisfactory.

The results of the inspection for contagion or infection should be noted on a filing card, which

record should be filed separately from the cards previously described in the "physical examination," although a cross-reference on the physical examination card should be made. Later, on this contagious card, there should be noted the results of treatment and the outcome of the case.

It is not suggested or advised that there be two sets of medical men examining and inspecting in schools, but it is urged that the two kinds of work are distinct, that the latter, medical inspection, is essential, and that as much of the former, physical examinations, should be undertaken as is possible. The work can be, at least in small districts, splendidly combined.

The same care should be exercised by the medical inspector not to overstep his rights, but to refer all cases back to the parents and the family physician, as was urged in the physical examination discussion. The trained nurse of each school or each district should follow up each case of infection sufficiently to determine that the child is being properly cared for, and that the infection of others is prevented. In all cases in which a complete examination is desirable the consent of the parents should be obtained beforehand. In all cases where any examinations of girls are made, the trained nurse should be present. A private examining room in each school will facilitate and minimize the objection to such examinations.

A FEW SUGGESTIONS FOR THE MEDICAL INSPECTOR

1. The medical inspector should note the vaccination mark (present, absent, character).
2. He should note skin eruptions.
3. He should look for evidence of body or head lice.
4. He should be on the lookout for trachoma (which in some regions is of frequent occurrence).
5. The inspector should make a careful examination of every child found by the teacher or trained nurse with eruption, sore throat, a suspicious cough, or fever.

6. He should examine all other children who are in immediate contact with the one who is ill or is found to have a contagious disease.

7. He should examine all other children who live in the same house as the one affected and who are attending school.

8. He should cooperate with the board of health to determine when a cured child should return, and when suspects should be subjected to, and when they should be released from quarantine.

9. When there is no physical examination of all children in a school as previously outlined, the inspector should make as much of an examination of apparently unhealthy children as possible. The important objects to be determined are: the condition of the teeth, nose, throat, eyes, ears, spine, feet, ankles, glands, heart, lungs, nutrition, mental condition, etc.

NUTRITION

Medical inspection should really be medical supervision at least with the aid of the trained nurse, and a great problem of child health and of prevention of disease is that of nutrition. Underfed children are in goodly numbers, as shown by such statistics as are available, and for such the question of the diet at home is important, especially the breakfast. The homes and diet of all ill-nourished children should be investigated by the trained nurse. The value of the school luncheon is unquestionable; however, its advisability must be determined by each community, but the actually underfed children must in some manner be provided with good food. There is no possible excuse for compelling a child to study who is receiving insufficient food.

EYES

A very large percentage of children of school age are found to have defective eyes. Such defects being discovered, how many receive the proper glasses, and then how many keep their glasses properly adjusted,

and how many have reexamination as often as they should (such examination should be once a year) to determine the changes that will occur? It is readily seen that the eye question is a serious one.

As many children as possible, who have been found to have defective eyes and eye-strain, should be sent by their parents to oculists of repute, and the danger of consulting opticians and so-called optometrists and department store eye clerks should be explained on a printed slip issued by the board of health or the school board. This paper should also urge that the child have spectacles with large sized lenses and rigid, light weight, inexpensive frames. There is no other method to equip an astigmatic eye properly, especially in children. All other frames, for a child, are a delusion and a snare. If a family can afford it, "dress up" gold or gold-filled frames may be had as an extra pair. Each child with glasses should have a good case for them, and in all rough games the glasses should be taken off and deposited in these cases and the cases placed in a safe spot. This detail may seem superfluous, but it is all-important.

If the visiting nurse ascertains that the parents are unable to pay for a skilled oculist's examination, or for the lenses, then the child should be sent to a regularly appointed oculist who receives a small salary for such services. Later the prescription for glasses should be taken to a regularly appointed optician or one of several who have contracted at minimum rates for such cases. Dispensary service for determining the correct refraction of a child's eyes for his life work is unsatisfactory and generally unavoidably bad. A child had better have no glasses at all than to have incorrect ones. Neither should it be expected that the oculist can devote time and science, unpaid, to such a nerve-tiring work as determining the proper glasses for children. They are willing to do emergency and eye disease work for the poor gratis, but eye refraction work should be

paid for. Why should a community demand that a child go to school and then demand that some member of the community, without pay, make the child fit to go to school? On the other hand, the correction of eye-strain in children not only causes them to learn with more ease, but prevents eye defects that may mean untold suffering for years after. The migraine sufferers will certify to the correctness of this statement.

TOBACCO: ALCOHOL

There is no question that during the teaching of school hygiene, during the study of physiology in school, and during the brief description of the action of, and the antidotes to, the more common poisons, the baneful effects of tobacco and alcohol should be honestly shown. It is of no more advantage to disseminate lies in regard to these narcotics and habit-forming substances than to teach any other branch of knowledge incorrectly. The truth is bad enough.

It is inexcusable for parents to give young children alcohol, but it is not wise to teach children that because their parents occasionally partake of a glass of beer or wine, they are condemned to perdition physically and morally. The higher standards of communities and the proper supervision of all places that sell liquor that is to be drunk on the premises will soon make overdrinking unusual except in the diseased. The moderate use of alcohol by adults must for some time be a matter for individual decision. Youth and those under age should not take alcohol in any form, not even tinctures or caffein stimulants at the soda-water fountains.

Much more serious for the many among our young boys and young men is the overuse of tobacco. Where one young man uses alcohol perhaps twenty use tobacco. Cigaret smoking in young boys is tolerated in some preparatory schools, and even in some public high schools. In fact, a large number of young men

under 21 years of age smoke excessively and to their detriment mentally and physically.

The symptoms and signs of oversmoking, the impaired chest and lung development, the impaired heart action, the impaired nutrition, injured nerves and weakened muscles are all matters of medical knowledge. These vary only in degree in young boys who overuse tobacco, and are all more or less in evidence sooner or later. Emphatically, growing boys should not be allowed to smoke, even if their fathers and teachers do.

AIR CONTAMINATION

Normally the alveolar air of the lungs, that is, the air retained in the lungs for oxygen and carbon dioxid (CO_2) exchange, contains about 5 per cent. of the latter. If the amount of this gas in the retained air is diminished below 5 per cent., breathing is slowed until the carbon dioxid has accumulated and this percentage is again reached. If the percentage of the carbon dioxid is increased above 5 per cent. the respiration becomes more rapid, until the amount again becomes normal.

The arterial blood leaves the lungs with the same percentage of carbon dioxid in it as is in the alveolar air, and this carbon dioxid content of the blood stimulates or depresses the respiratory center, depending on the amount of the carbon dioxid in the blood. Therefore, this gas is a regulator of the respiration. Exercise increases the carbon dioxid, and hence the respiration is increased.

The alveolar air contains about 16 per cent. of oxygen, and the red blood-corpuscles in the blood of the left heart normally contain all they will absorb. Crowder[3] says that if the oxygen is diminished in the lungs to 12 per cent. or less the corpuscles will still take up their full quota. He also states that neither a surplus nor a deficiency of oxygen in the air supplied

3. Crowder, T. R.: On the Reinspiration of Expired Air, Arch. Int. Med., October, 1913, p. 420.

the lungs, unless the difference is extreme, will cause a change in the oxygen content of the red corpuscles. Actual need of oxygen will not increase respiration if at the same time the carbon dioxid in the alveolar air is reduced; that is, the carbon dioxid must equal 5 per cent. for normal respiration to occur. He emphasizes the fact that "with each breath we take back into the lungs the air contained in the nose and larger bronchi — the 'dead-space' air. This 'dead-space' air constitutes about one-third of the whole volume of quiet inspiration and not less than one-tenth of deep breathing. To all intents and purposes it is expired air which is constantly reinspired."

Hence the degree of contamination of the air in a room with carbon dioxid does not affect the individual, but the amount of water vapor does. It is not rebreathing the same old air, either of our own breath or of others, that mainly affects us, but it is the water vapor which prevents the air exchange on the surface of our bodies, and especially stagnant, overmoist air, that depresses and debilitates us.

Crowder has fully shown that we rebreathe our own inspired air over and over again. Hence it is not pure air we breathe. This is true when at rest, true when in bed, especially true in some confined sleeping positions. It is true with open windows, and in most tents and on verandas, and even in actual open air, unless the wind blows freely across our faces. In the latter case the depth of the breathing is reduced, and we might reexchange the air of the upper air passages more or less all night even while sleeping with the face exposed to the wind.

None of this militates against the value of clean, fresh air as a stimulant to the metabolism, and therefore to health, but it does show that the chemical constituency of the air is not primarily important, while the temperature and moisture are. Dry, cool air is bracing; dry warm air, if in motion, may be comfortable and not depressing; but warm, moist stagnant air

is very depressing to metabolism, and hence when such a condition occurs in houses, stores, factories or assemblage halls harm is done to the individual in amount depending on the hours he spends in such an atmosphere. Overheating of houses and schoolrooms is harmful; too great humidity is also bad, although a too dry atmosphere is not desirable.

DISSEMINATION OF CONTAGION

The wonderful progress in medicine is in no way shown more than by the knowledge acquired by the bacteriologists and by the wonderful experimental work of the laboratory workers. The various funds devoted to this work are paying large dividends in preventive medicine. Experimentation with the higher animals which more closely resemble human beings has disclosed many truths hitherto unknown regarding pathology, bacteriology and contagious diseases.

It was formerly believed that infectious material, which was not then known to consist of micro-organisms, was carried through the air for considerable distances. With small-pox it was believed that infection could travel several thousand feet. It has now been shown that this disease cannot pass through the air more than a few feet.[4]

Infectious material from patients suffering from disease of any kind may adhere to clothing, furniture, books and similar articles and may be carried from one person to another and be a means of infecting other individuals, but this method of transmission is at the present time believed to be uncommon. Ordinarily a contagious disease is acquired by direct contact and largely by the patient breathing in germs or particles of infected matter which have been expelled from the person affected with the disease by sneezing, coughing, or even loud talking.

4. Kiefer, G. L.: The Control of Contagious Diseases in a Municipality, The Journal A. M. A., Dec. 7, 1912, p. 2022.

A frequent means of transmitting disease from one person to another is by so-called "missed cases," that is, patients who have the disease in such a mild form that it is not recognized. This is especially likely to happen with diphtheria and scarlet fever. Another frequent source of acquiring disease is by means of so-called "carriers," that is, persons who have in their throats or other parts of the body the micro-organism of a disease, but who do not know they have the disease and are not made ill by the germs.

Some pathogenic bacteria die so quickly after leaving the body that infection from dust or air contaminated by them is practically impossible. Such are notably the germs of influenza, cerebrospinal fever and gonorrhea. In these diseases direct contact is the only probable method of transmission. This does not detract from the fact that not infrequently contagion is conveyed to well persons who come in contact with mucus or mucopus containing living germs.

Tubercle, diphtheria and typhoid bacilli, on the other hand, may survive drying and be wafted in the dust, but infection by means of such dust is probably very rare. Droplet contamination of air and of articles immediately about a person infected with pulmonary tuberculosis or diphtheria frequently occurs.

The air of sewers has been shown to contain few pathogenic organisms, except in very rare instances. A few colon bacilli have been found, but then in such small numbers that the danger of infection from inhaling such gas is practically nil.

Even if the dust of a room is shown to contain viable tubercle or typhoid bacilli, the number of such in the upper air of the room would ordinarily be so few that infection in this way is practically impossible. Young children playing about the floor of such a room, however, would be in danger of infection, and infection with tuberculosis in children is doubtless frequently thus acquired.

Investigation seems to show that the pathogenic bowel germs are rarely air-borne, and that the infection cannot be thus acquired. Such germs are those of typhoid fever, paratyphoid fever, dysentery, diarrhea and cholera. Typhus fever is not air-borne, but is due to the bites of the infected body- or head-louse. Bubonic plague is transmitted by the bite of an infected flea.

The rapidly spreading influenza (the grip) seemed surely to be disseminated by dust or to be air-borne, but it seems that, like tonsillitis, diphtheria and ordinary colds, it is contracted by contact either with the infected person or with contaminated substances, as clothing, handkerchiefs, furniture, eating and drinking utensils, etc. The same is true of eye inflammations and contagious skin diseases. This has long been known to be true of syphilis and gonorrhea.

Much more difficult for medical men, to say nothing of laymen, to believe is what must now be considered a fact, namely, that the scales of desquamating scarlet fever are not contagious and do not carry the contagium; scarlet fever is spread only by contact with the infected person or with articles infected by the patient having the disease.

Measles, apparently the most readily spread of any contagion, seems to be transferred only by contact. It was suspected that this disease was transmitted by the air because a child could disseminate it so many days before he was actually sick and confined to the house or bed. Whooping-cough, "German measles" and chicken-pox are all probably spread by contact and not by diffusion through the air. Small-pox, as stated above, is spread only by contact.

It has been shown in hospitals that if the nurses are careful not to allow contact with other patients, small-pox, measles and scarlet fever, the most contagious of all diseases, may be cared for in adjacent wards, and even, in careful experiments, in adjacent

beds, without infection of others. Of course, such close association of a contagious disease with those who have not the disease is absurd on account of the failure, in the routine work, of nurses and attendants to carry out strict measures to prevent contact or the transmission of contaminated articles from one to another. Therefore, there should be separate wards, if not separate buildings, for the different contagious diseases; but the experimentation mentioned above shows conclusively that these diseases are spread by contact only.

It is now recognized in hospital operating rooms that droplet infection is a danger, if all other sources of infecting the wound are excluded, and hence surgeons and their assistants wear mouth and nose covers lest they cough, sneeze or speak energetically, and thus spray the region of the wound.

It is hardly probable that pneumonia and acute rheumatism can be spread in any other way than by contact. It is possible that these more or less constantly present germs may require only a certain condition of the mouth, upper air passages and system to infect us. Cerebrospinal fever and infantile paralysis doubtless require contact, and are probably not air-borne. It should also ever be remembered, in considering the possibility of an air- or dust-borne infection, that it requires a large number of most germs to cause an infection; a few would ordinarily be killed off before infection could occur.

FLIES

The ubiquitous fly is a menace and a distinct and positive source of danger. He can disseminate typhoid, diarrhea and dysenteric germs, and probably also the germs of tuberculosis, diphtheria, scarlet fever, cerebrospinal meningitis, small-pox, carbuncle, tetanus, rabies, anterior poliomyelitis, and even germs from granular lids. Also these insects can harbor, for long

periods, in their bodies the various pathogenic germs. Frozen flies from a hospital, after being externally cleansed and dried and then powdered and cultured, have been shown to harbor staphylococci, streptococci, colon bacilli and about fifty other kinds of bacteria. Experiments have shown that when a fly is fed on such bacteria as the typhoid bacillus and streptococci, and later cultures taken from its dead body, these cultures will show pure growths of the bacteria on which the fly was fed.[5] Consequently, not even a dead fly is a good one, and all dead flies should be cremated if not washed down the sewers.

House and stable flies are not supposed to stray ordinarily more than 500 yards from their breeding-places, but winds may carry them farther. It should be regarded as an axiom that all breeding-places (manure heaps and filth) should be abolished, or receive such treatment as to prevent the growth of the flies, and in this object there should be cooperation of families, tenement owners, towns and cities.[6]

Infected flies may be readily carried on horses or in vehicles of all kinds for long distances, and may be the source of infection of patients far removed from the contagion, and the transportation of germs by flies doubtless accounts for many new foci of disease.

MALARIAL FEVERS

Thousands of lives are lost in the United States from malarial fever, and many thousands of persons are incapacitated for days and weeks by such fevers.

Although the subject of mosquitoes has already been touched on, it may be again emphasized that the public should know, and children in schools should be taught, that the anopheles mosquito, which inhabits swampy places and does not ordinarily fly far, and only comes

5. Berezoff: Russk. Vrach, June 29, 1913.

6. For methods of prevention of the growth of flies see Department of Agriculture Bulletin 118, issued July 14, 1914.

out of its lair and bites at night, is the only source, as far as we know, of what is termed malarial fever.

This mosquito is innocent of harm until it has sucked blood infected with malarial plasmodia, capable of development, from a human being. When these germs develop into spores and are excreted by the mosquito's salivary glands she is able to infect an innocent human being. The female mosquito will harbor these germs until she dies, unless she is subjected to a temperature below 60 F. Hence in regions where the temperature falls below this point for a shorter or longer period, these infected mosquitoes are no longer able to infect human beings. The source, therefore, of the next season's infection is in human "carriers" of malarial germs, in most parts of our continent, except where it is always warm.

The question, then, is, Can we eradicate malarial plasmodia from human beings? Probably yes is a correct answer if we follow what has been scientifically ascertained, namely, that quinin in proper dosage will stop acute malarial fever in two or three days. But as this quinin destroys only the asexual forms, that is, the form that causes paroxysms, while the sexual or reproductive forms may live and redevelop for infection of the mosquito, or to cause a reinfection and symptoms in the patient, the drug should be again given for two days of each week for a period of eight weeks to be sure of complete elimination of the germ; or it may be as well to give the patient a daily dose for eight weeks to eradicate the germs and their spores completely and to prevent the infection of future mosquitoes. If every physician carried out this plan, and every patient allowed it, malarial fever would become unusual.

It may again be mentioned that kerosene or crude petroleum sprayed on stagnant water or wet places will prevent the development of mosquitoes. One ounce of kerosene will cover 15 square feet of water surface. Stagnant water should not be allowed.

DISINFECTION OF SCHOOLS

In view of the fact that contact is apparently a necessity for the spread of almost all, if not all, of the contagions that visit schoolchildren, disinfection, as so long practiced, is unnecessary and a delusion. Also the closing of schools is unnecessary. Fumigation of schoolrooms and schoolbuildings has been abolished in many large cities. The ordinary care of the schoolroom involves the free admission of sunlight and pure air and the removal of dust by a vacuum cleaner or by moist sweeping or mopping.

If a contagious disease occurs, (*a*) the child's desk, chair, and the immediately surrounding desks and chairs, as well as the floor, should be sprayed and washed with a strong solution of a germicide or disinfectant. (*b*) The child's books, pencils, etc., should be destroyed, unless the books are valuable, in which case they should be subjected to dry heat or to formaldehyd cabinet fumigation. (*c*) The pupil's clothing should be boiled or efficiently fumigated before he returns to school.

There is no question that most all so-called children's contagious diseases are more prevalent during the months that schools are in session than during vacation times. Hence schools do distribute infection by allowing crowding and close association with infected persons; also because the confinement diminishes the resisting power of the well. Therefore, the necessity for cleanliness, freedom from dust and for fresh air and sunlight is readily recognized.

DISINFECTION

Fresh air and sunlight let freely into infected rooms and into the sickrooms aid in killing germs and curing the patients. Schoolrooms with open windows and open-air schools have less contagion than ordinary schoolrooms.

Oxygen is not a very active bactericidal agent. Ozone if brought to the germ is effective, but pure ozone is difficult to furnish to infected rooms or to introduce into infected parts of the body, and ozone treatments of infection are generally fallacious and fraudulent. Hydrogen peroxid solutions, if fresh and uncontaminated, are efficient in killing germs, when brought into contact with them. To be efficient the strength should be 50 per cent. of aqua hydrogenii dioxidi.

Fumigation after scarlet fever, diphtheria and measles does not seem to pay for the cost and trouble it causes, and should be abolished. Proper fumigation with strong formaldehyd, carried out by boards of health, should still be done for small-pox and tuberculosis, and perhaps for erysipelas, childbed fever and tetanus, especially in hospitals. Spraying with germicides of all the immediate surroundings of an infected patient is the method of disinfection now most satisfactory. All washable clothing and bedclothing should be boiled: all other clothing should be baked and put into the sunlight. Carpets and rugs should be washed with antiseptics. Various washing solutions may be used, such as chlorinated lime solutions, 5 per cent., formaldehyd solutions, corrosive sublimate solutions 1 : 500, 5 per cent. phenol (carbolic acid) solutions, or better, the higher coal-tar disinfectants, as liquor cresolis compositus. The New York Board of Health orders the woodwork and floors scrubbed with hot solution of 1 pound of washing soda to 3 gallons of hot water. Bedding and night clothing are ordered soaked in phenol solutions and then poiled in soapsuds for half an hour. Books and toys should be burned.

Dr. Dixon,[7] Commissioner of Health of Pennsylvania, suggests as a substitute for the combination of potassium permanganate and formaldehyd, the following: "sodium dichromate, 10 ounces avoirdupois; sat-

7. Dixon, S. G.: A Substitute for Potassium Permanganate to Liberate Formaldehyd Gas from a Water Solution, The Journal A. M. A., Sept. 19, 1914, p. 1025.

urated solution of formaldehyd gas, 1 pint; sulphuric acid, commercial, 1½ fluidounces." He states that the sulphuric acid and formaldehyd gas form a stable solution. "This, after it cools, should be poured over the crystals of sodium dichromate spread out in a thin layer over the bottom of an earthenware vessel having ten times the capacity of the volume of the ingredients used." He finds this process more rapid than the combination with potassium permanganate.

The danger to others lies in carriers and missed cases, those who are so mildly sick as to escape medical care.

The contagious disease hospital is the only safe place for tenement cases; this prevents the infection of others, as families in tenements have no isolation rooms and no trained nurses to carry out disinfection.

PERSONAL HYGIENE OF SCHOOLCHILDREN

The schoolteacher and the trained nurse should note and correct many things found wrong in a child. They should also teach many simple truths as to hygiene. Only a few obvious hygienic mistakes will be touched on before conditions that may cause infection of others are discussed.

Feet.—A good working rule is for broad-toed shoes always; no heels for the earlier years of the child; low heels later; and if must be, still later, heels a little higher. Rubber heels are all right if desired, but not rubber soles, unless perhaps for playing tennis. The weight of a rubber-soled and heeled shoe is too great for constant, or even for a few hours' continuous use. Also, completely rubber-soled and heeled shoes cause the feet to perspire, to say nothing of the undesired insulation of the person. Low shoes for summer, high shoes for winter and rainy weather, and storm shoes or rubber overshoes for rain and snow are necessities for health. If a child wears rubber boots in stormy weather, they should be removed while in school.

Occasional observations of a child's feet and insistence that proper shoes be worn will prevent future corns, bunions and weakened arches. Too short and too narrow-toed shoes ruin the feet of young men and young women. Also, this continuous dancing fad causes corns and callouses to occur on different parts of the toes, which means future trouble, if not properly cared for or prevented.

Hygiene of the Skin.—Briefly to refresh our memory as to the anatomy and physiology of the skin, it may be noted that the different layers of the cells of the epidermis, or horny layer of the skin, change their chemical structure as they advance to the outer layer. They gradually die, so to speak, and then are cast off. This layer contains no blood-vessels and no lymph-channels, and is a distinct protection to the body against the absorption of toxins and germs. If this layer is broken by injury, an absorptive area is immediately presented, and infection may readily occur. Nature makes this protective layer thickest where injury is likely to be the greatest, such as the palms of the hands and the soles of the feet. The hair and nails are really projections of this layer of horny cells.

Some drugs in solution or ointment may be rubbed or massaged through the horny layer into the layers of absorption, that is, the rete layer. Irritants may also reach this layer after more or less corrosion or removal of the epidermal layer, and local inflammation may be caused. It is the rete layer that is especially inflamed in many conditions of eczema.

The sebaceous glands of the skin may be overactive or underactive. If they are overactive, too much oily substance reaches the skin and hair and the parts become greasy. If the opening of a gland becomes clogged with dust or other particles, the canal and gland become more or less congested and the result is a so-called comedo or blackhead, and pathogenic germs may grow, especially the pus-forming germs, and

a condition of acne or infection occur. If these sebaceous glands secrete insufficiently, the skin becomes dry and scaly, perhaps brittle, cracks readily, insensible perspiration is interfered with, and the whole system may be more or less affected, depending on the seriousness of this condition.

The sweat-glands must be sufficiently active for the body to be in perfect health; they largely eliminate water, reduce the temperature of the body and keep the internal temperature normal. The few salts and the small traces of nitrogen that are eliminated by the sweat-glands may be disregarded; suffice it to say that the excretion of poisonous nitrogen compounds by the sweat-glands is very small. The odor of the perspiration varies with different individuals and with different races. Not infrequently it is intensely disagreeable, and the secretion, both as to odor and character and the amount of decomposition of fatty acids, varies with the part of the body from which the perspiration comes. When the sweat from an individual gives off a very disagreeable odor, the condition is termed bromidrosis, and requires treatment by a physician. The condition should be noted in children, and prevented if possible.

Dandruff and dirty, greasy scalps and insufficient cleanliness of the hair should be noted, and instructions given as to the proper care of the child's head. A good daily brushing, and a simple castile soap shampoo weekly (or at least once in two weeks), with proper drying of the scalp, should be given by the mother.

Besides the advice given the parents as to the care of the child's scalp, the teacher or nurse should note the condition of the child's skin as to cleanliness, greasiness, dryness or eruptions, and proper advice should be transmitted to the parents. Also, the condition of the clothing and the kind of underclothing

should be noted, especially in young children, and if considered improper, similar advice should be given the parents on the subject of underclothing.

Children and parents should be instructed not to use strong, irritant soaps, and parents should be urged to seek medical advice when a child's skin is too greasy and acne of the face is beginning to develop, when the child's skin is too dry for health, and when there is any eruption. They should be warned against the use of all nostrums, whether ointments or liquids, as liable to cause more harm than good. Parents should be advised to give their children only the simplest kind of food, to give them no tea and coffee, and to forbid their eating large amounts of sweets; especially is such advice necessary when there are eruptions on the skin.

Contagious Skin Diseases—The principal contagiums that occur on the skin of schoolchildren are ringworm, body- and head-lice and scabies. None of these conditions can be well treated at the school or in dispensaries, but the treatment must be carried out at the home of the infected child. No verbal or written instructions will accomplish half so much as a visit from the trained nurse and her personal instruction of the parents. Also she can take a general survey of the other children of the family and of the household.

It is not necessary to describe the treatment for these several troublesome but simple conditions. The various parasiticides are well understood, but the whole success of treatment lies in the care exercised and the curative measures taken in the child's home. When the patient's family can afford it, the Roentgen-ray treatment of ringworm is perhaps the ideal treatment.

Body-lice rarely occur in children and demand a cleansing bath and the baking of the underclothing in an oven at a temperature above the boiling point, but not high enough to burn the clothing.

Pediculosis Capitis.—Aside from being an evidence of neglect, the head-louse may be the means of conveying infection, for example, of typhus fever.

Dr. Jacob Sobel[8] of the Department of Health of New York City describes the method of handling this infection in New York, and also shows how greatly the disease has been reduced by the home instructions that the board of health has inaugurated. Following are the instructions issued by the New York board of health to the parents of children who are found to be infected with pediculi:

Children affected with vermin of the head are excluded from school. The following directions will cure the condition:

Mix ½ pint of sweet oil and ½ pint of kerosene oil. Shake the mixture well and saturate the hair with the mixture. Then wrap the head in a large bath-towel or rubber cap so that the head is entirely covered; the head must remain covered from six to eight hours.

(Tincture of larkspur may be used instead of oil mixture. The directions for use are the same.)

After removing the towel, the head should be shampooed as follows:

To 2 quarts of warm water add 1 teaspoonful of sodium carbonate. Wet the hair with this solution and then apply castile soap and rub the head thoroughly about ten minutes. Wash the soap out of the hair with repeated washing of clear warm water. Dry the hair thoroughly.

·Nits: If the head is shampooed regularly each week as above described, it will cure and prevent the condition of "nits."

Vulvovaginitis.—Just what methods are advisable to determine that a female child has vulvovaginitis, which may be transmitted to others by the school water-closets and by other means of transmission, is difficult to outline. It must be recognized, however, that a great deal of this condition occurs in young girls. The discharge may be non-specific, or may be associated with some eruption or irritation of the genital region,

8. Sobel, Jacob: New York Med. Jour., Oct. 4, 1913, p. 656.

or it may be actually due to an infection from gonococci. Microscopic examination and bacteriologic cultures are the only means of determining the character of the discharge.

It being ascertained that a girl has a discharge, it is the duty of the medical inspector or trained nurse to insist that the family have their physician properly treat the patient. The necessity of bacteriologic examination must be emphasized, the danger of contagion urged, and the necessity for ascertaining the source of the child's infection discovered, if possible.

It is certain that these little patients frequently masturbate; whether this is a cause of the inflammation, or whether the irritation causes the bad habit, is a matter of unimportance. Feeble-minded girls are likely to have a vaginal discharge, and have been found to be often infected with gonorrhea.

Dr. F. G. Taussig[9] urges the following measures to prevent the vaginal infection from entering institutions such as orphan asylums and children's homes:

First, he would examine a vaginal smear from all girls applying for admission, and if gonorrheal infection is discovered, the child should be excluded until cured. If the disease is discovered in an institution, the patient should be isolated and the nurse in attendance should take measures to prevent the infection of others.

As further preventive measures of gonorrheal infection of female children, Taussig advises that 1 drop of a 2 per cent. silver nitrate solution be instilled into the vestibule of the vagina at the birth of every female child whose mother shows evidence of gonorrhea. He would advise this even if only about 5 per cent. of gonorrheal vaginitis in young children occurs directly after birth. He also believes that "the adoption of the U-shaped seat with low bowl and other precautionary measures to prevent the spread of the infection

9. Taussig, F. G.: Am. Jour. Med. Sc., October, 1914, p. 480.

in the lavatories in schools, playgrounds, comfort stations and tenements" would prevent a great many cases of innocent infection.

The curative treatment is the gentle, frequent cleansing douche, as warm boric acid or borax solutions, and the more or less frequent applications of silver salt solutions. The little patient should not be considered cured until several examinations of the smear have shown gonococci to be absent.

CARE OF THE TEETH AND MOUTH

The importance of oral cleanliness is becoming more widely recognized. The discovery that individuals, apparently well, may be carriers of pathogenic germs, especially of the bacillus of diphtheria, of the pneumococcus and of the bacillus of influenza, makes persons so infected a menace to their associates. How frequently the pneumococcus causes pneumonia in one who carries this germ accidentally is of course not known. Whether an individual who develops pneumonia always receives an acute infection with this germ, or whether, becoming debilitated by an influenza or a cold caused by some other germs, he has his resisting power so reduced that the pneumococci present in his mouth and throat cause active infection, cannot readily be determined. Streptococci and staphylococci are of frequent occurrence in the mouth, especially when there are decayed teeth, or diseased gums, tonsils, noses or any of the sinuses surrounding these regions. Whether these germs so present in a person's mouth frequently or infrequently infect others need not be considered. It is certain that the carriers of the germs are a constant source of danger to themselves, not only on account of the local disturbance, which may become more or less permanent with more or less disorganization or disintegration of solid tissues, but also from the danger of septic and pyemic infection. From such local infections joint inflammations are fre-

quently caused, whether or not this is the case with true rheumatism, endocardial inflammations, and possibly such serious blood disturbances as pernicious anemia or leukemia. More or less serious glandular disturbances may occur from these local putridities or suppurations and the lungs are in constant danger from infection from these organisms. Some of these bacteria may also cause conditions that allow an infection by tubercle bacilli. Chronic nephritis must also be listed as an occasional consequence of a local infection in the mouth, nose or throat.

More or less constantly these pathogenic germs must be swallowed with food, drink and saliva. Probably most of them are killed by the hydrochloric acid of the gastric juice, provided the stomach is normal. If the stomach secretions are imperfect or if there is a chronic congestion of the mucous membrane of the stomach, many of these germs doubtless pass alive into the intestine and may there be a cause of a chronic enteritis or an infection of the gall-bladder, or they may possibly disturb the pancreas, and may be the cause of an ultimate incurable organic disease or incurable blood disturbance.

The corollary of the foregoing, and the possible and more or less frequent results of mouth infection which have not been overestimated, is cleanliness of the mouth, nose and throat. The teeth and mouth should at least be thoroughly cleansed on rising in the morning and on going to bed at night. A thorough use of the tooth-brush with such tooth-powders or tooth-pastes as seem advisable, depending on the age of the person and the condition of the gums and the character of the deposits that occur on the teeth, should be made daily. Some teeth cleanse readily and do not require a very stiff brush or very harsh treatment. Others need a stiffer brush and a powder, not too soapy, for complete removal of all deposits. If the gums bleed readily, they should be hardened with simple astringent

washes, either a dilute alcohol or a dilute astringent tincture such as myrrh, or a tannic acid wash. Potassium chlorate mouth-washes and gargles are very soothing to irritated mucous membranes, but ordinarily any simple alkaline wash or mildly antiseptic solution as borax or boric acid solutions will be found sufficient, with the proper rubbing of the gums with a not too hard tooth-brush, or rubbing the gums with the fingers, that is, massage. The powder selected for cleansing the teeth is generally alkaline, with chalk or magnesia, but it has been shown that acid cleansing preparations, especially the acid fruits, are more efficient in causing the death of bacteria that occur in the mouth.[10] Whatever powder is chosen, it should contain no hard crystals that could possibly injure the enamel of the teeth.

A few children have never been taught to cleanse their teeth at all; many children have never been taught the proper manner of cleansing their teeth. Consequently, it should be the duty of the trained nurses of schools not only to examine the condition of the teeth and mouth of the children, but also to instruct them how to use their tooth-brushes, and what the hygiene of the mouth means. Some physicians urge that there should be daily gargling with some simple mouth-wash or physiologic saline solution, and also urge the snuffing into the nostrils and then expelling of such solutions. Theoretically, cleansing of the nostrils from the dust and bacteria inhaled should be a daily duty. Washing the mouth and throat with some simple solution should also be daily done. Practically, however, it is difficult to enforce such advice. Also, as far as the nostrils are concerned, solutions and sprays may irritate the mucous membrane, or may remove Nature's protective mucus. For this reason it may not be advisable generally to recommend wash-

10. Oral Cleanliness, Therapeutics, The Journal A. M. A., Nov. 8, 1913, p. 1719.

ing of the deeper parts of the nostrils with antiseptic or other solutions.

The removal of hopelessly decayed teeth and the filling of the cavities in teeth that can be preserved are essential to health. The trained nurse should discover such teeth in children and strongly advise, if not insist, that they be properly attended to. Alveolar abscesses, or other localized infection, should be treated by the physician or dentist until cured. Temporary frequent washing of all pus parts, unless the cavity is more or less closed, with hydrogen peroxid solutions, the dilution depending on the part affected, is efficient until the diseased part can be more thoroughly treated.

Pyorrhea alveolaris, very frequent in adults, very rare in children (unless the child is generally debilitated, or in children who have rickets) is a germ disease that is cured only by the most persistent and continuous treatment. Cleanliness and antiseptic washings are the means of prevention, but these rarely will cause a cure. Iodin treatment by the dentist will sometimes cure up pockets of infection. In inveterate cases vaccines, especially autogenous vaccines, have many times proved efficient. Sinus diseases are well treated only by nose and throat specialists.

Let it be urged that it is a mistake to retain too long a tooth that is causing disturbance. Many a serious condition and a great deal of jaw, and even antrum trouble has been caused by trying to preserve a tooth that is diseased at its root, or has a pocket of infection running down from the gum toward the root. A tooth that is diseased and cannot be well treated from the surface and which tends to cause serious disturbance of the fifth nerve, and especially if the pain comes in spasms, cannot be too soon removed. Dentists are often too conservative. Roentgenograms of the conditions in a jaw will often show a diseased tooth, or ill-placed teeth, which may be the cause of pain.

A few more suggestions might not be out of place.

First, the tooth-brush should not only be a good one, and not have loose bristles to cause injury or to be retained in the mouth or throat, but the brush should be deposited in an antiseptic solution. Of what value is it to cleanse the germs from the mouth and teeth and then allow them to grow in the tooth-brush to become a source of infection for following days? After using, the tooth-brush should be cleansed and placed in a test-tube or a bottle holder with alcohol or in a weak formaldehyd solution, as 1 part of liquor formaldehydi to 25 parts of water.

Second, the constant and frequent use of hydrogen peroxid solutions, which has become more or less of a fad with many persons, is a mistake. It is not good for the teeth, and not good for the gums, although it is used and should be used in septic or infected conditions, but not then for too long.

Third, the teeth and mouth should receive a great deal of care and attention during all illness, whatever that illness may be.

Fourth, before all operations which are not of the emergency type, the teeth and gums should be put into good condition by the patient's dentist. Before operation in all cases the mouth, teeth and gums should be thoroughly cleansed and cleaned with hydrogen peroxid or other antiseptic solution.

ADENOIDS; HYPERTROPHIED TONSILS; OTORRHEA; CERVICAL ADENITIS

While any one or any two of these conditions may occur without the others, they are all more or less closely associated, and the schoolteacher and the trained nurse should take note if any one of them is present in a child, and the child should then be sent to the medical inspector or medical examiner. The importance of treating hypertrophied and diseased tonsils has already been discussed. The association of

mouth and throat diseases with cervical adenitis is well understood. Also the necessity for removing obstructive adenoids which hinder proper breathing and prevent the removal of dust particles and germs and the warming of the air, requires no discussion.

Adenoids not only cause and allow nasal catarrh, recurrent tonsillitis, chronic pharyngitis, and even bronchitis with perhaps, later, the development of cervical adenitis, but they may also be a cause of obstruction of the eustachian tubes and disturbance and infection of the ears. They may allow infection of the sinuses associated with the nostrils, and they may prevent the proper development of the bones of the face, the proper growth of the nose and cause that vacant, open-mouth expression, which is so perfectly characteristic of this simple but frequent condition. It is needless to urge that the earlier obstructive or hypertrophied adenoids are removed, the less likely are complications to occur and the more normal will be the growth of the bones of the face, nose and jaw.

The seriousness of discharging ears will be recognized when Dr. N. P. Stauffer's statements[11] are repeated, that, of 90,000 deaf persons in the United States according to the census of 1900, 51,000 were deaf from childhood, that 75 per cent. of deafness is caused by discharging ears, and that 75 per cent. of discharging ears is due to adenoids and hypertrophied tonsils.

With acute adenitis the child has a high temperature, and it is soon recognized that he is sick. It should be remembered that a child may have folliculitis in the nasopharynx which may give infection to others much the same as follicular tonsillitis. With chronic enlargement of the cervical glands the little patient's temperature and nutrition should be carefully studied. Also any focus of infection in the throat should be noted.

11. Stauffer, N. P.: New York Med. Jour., Oct. 10, 1914, p. 705.

The best management for the individual patient with an enlarged gland or glands is for the decision of the family physician. Not all enlarged cervical glands are tuberculous; not all enlarged glands should be removed. A suppurating gland, however, should never be neglected. Also, chronically enlarged cervical glands may become infected with tuberculosis, or may be the beginning of more serious glandular trouble, as Hodgkin's disease. In other words, enlarged glands should always be looked on with suspicion, and generally the parents should be advised that the child should not remain in school, but may perhaps attend an open-air or open-window school. The treatment should be decided by the family physician. It should be noted, however, that iodid surely, and arsenic perhaps, will stimulate a tuberculous process to more widespread activity. Whatever is done, it should be emphasized that a child with enlarged glands of the neck is under suspicion of ill health as long as such glands are in evidence.

CHAPTER IV

THE COMMON INFECTIOUS DISEASES

PREFACE

Before taking up these diseases separately, it may be well to quote Vaughan's Harvey Lecture[1] as to what is scientifically understood by a germ pathogenic to man, and just what infection means. Briefly, Vaughan says that it is the protein poison produced by the germ that causes symptoms. If the germ does not find in our bodies an albumin suitable for its food, it dies and is not pathogenic to us. Also, if our tissues, in individual cases, can produce antibodies or opposing serums or antitoxins rapidly enough to overcome a germ which does find suitable food albumins in us, it will die before it intoxicates us, and we become, at this time at least, immune. Vaughan also says that acute disease or intoxication results when there is rapid multiplication of the infecting germs that find suitable pabulum, its protein toxins causing rapid sensitization of our systems, and a resulting fever which is of benefit. If the production of these pathogenic germs is slow, the result is a chronic infection, and when the proper albumin for the food of these germs is formed only in restricted areas, the result is a local infection.

1. Vaughan, Victor C.: The Phenomena of Infection, The Journal A. M. A., Feb. 21, 1914, p. 583.

DISEASE OF THE RESPIRATORY TRACT

Next to disturbances of nutrition in infants and young children, colds, inflammations of the air passages, are the greatest menace to health. Colds far surpass in frequency any other disease condition. Generally, the older the child, the less frequent the colds, but the susceptibility to catching cold, or the cold habit is of very frequent occurrence in individual children, in some youths, and even in adults. There is no immunity acquired by surviving a coryza, a pharyngitis or a bronchitis; in fact, ordinarily, the person is at least temporarily more susceptible to taking or developing a fresh cold. This may not be quite true of an influenza or grip cold, because many persons have a real or pseudogrip attack early in the fall or winter and are then more or less immune from acute attacks during the rest of that season; but there seems to be no doubt that the influenza bacillus leaves a patient temporarily, at least, more susceptible to other more dangerous germs, as the pneumococcus or tubercle bacillus. Consequently, besides the immediate debility that an acute cold causes, the possibility of opening the way for the entrance of more serious disease should cause every cold to be considered seriously and treated energetically. Also, it should be the object of every mother, nurse, family physician, schoolteacher, medical inspector, board of education and board of health to inaugurate every means possible to prevent colds, that is, to develop the resisting power of the individual; to see that the child is properly clothed; to see that the house and schoolroom air is as free as possible from dust and germs, and that it contains the proper amount of moisture, and to take measures to prevent individual contagion and widespread irritation of the upper air passages from irritants in the air of buildings and localities.

While it is asserted by some that acute colds are always due to germs of some kind, it is conceivable that

a too dry atmosphere, which is the condition in so many houses to-day, may so irritate or congest the nostrils as to allow the least irritant to cause at first a simple inflammation of the mucous membrane, which congested area may later pick up and harbor, or cease to kill, germs. It seems to be an established fact that good outdoor air does not predispose to colds as much as indoor air, and it is a fact that persons whose occupation is indoors are more liable to have colds than those whose occupation is outdoors. Whether or not every cold is due to contagium or to a germ, chilling, whether indoors or outdoors, certainly predisposes to colds. It is quite probable that chilling of the surface of the body congests the inner organs and possibly the mucous membranes of the air passages. If the mucous membrane of the nose is congested, it more readily becomes inflamed by irritation or by germs.

To repeat, every cold, especially in a young child, should be considered serious. The possibility and the frequent occurrence of complications such as middle ear inflammation, inflammation in one of the accessory sinuses of the nose, broncho-pneumonia or lobar pneumonia must always be a subject for consideration and prevention if possible. Colds and throat infections are also likely to cause enlarged cervical glands and perhaps enlarged bronchial glands. Any one or more of these glands may become infected with tuberculosis. Again, most colds, if not all, are contagious, and are transmitted by contact through families or close associates, and are especially spread by contact in schools.

The first step in the prevention of colds is to ascertain if the child properly breathes through its nostrils. Adenoids and greatly enlarged tonsils should be operatively treated. Hypertrophied mucous membrane or deformed nostrils should be surgically treated, if deemed advisable. The nutrition of the child must be good; if a child is underfed, he must receive more food. If a child is anemic, he must be properly treated with fresh air, good food and iron. Any chronic disease

must be discovered. Swabs should be taken from the nose and throat, and cultures made to ascertain if the child is harboring a recognizable pathogenic germ.

ACUTE CORYZA

This acute nasal catarrh, often called a "cold in the head," is of frequent occurrence in some regions, especially near the seacoast, and occurs repeatedly in certain persons who seem to have a susceptibility to inflammation in the nose. Some persons cannot be exposed to a single draft on any part of the body without an acute coryza starting. Whether their mucous membranes are in such a condition as to allow a recurrence of inflammation from dust irritants or from the congestion caused by chilling, or whether they more or less constantly harbor germs which cause another acute infection, if the mucous membrane is again congested, is a question that has not yet been positively determined. It is supposable, however, that while most acute nasal catarrhs are due to infectious germs, more or less chronically hypertrophied mucous membrane and more or less sluggish circulation in this membrane may allow simple non-infectious catarrhs to occur when irritation of any kind is applied. Other persons who do not have this susceptibility may become chilled, may be subjected to violent cold, damp winds, and may even get wet and still never develop a nasal catarrh. Just as large tonsils more readily catch germs and become diseased, or more readily harbor germs and have recurrent inflammations, so hypertrophied mucous membrane of the nostrils becomes susceptible to reinfection or to reirritation. Frequent acute colds, more or less constant subacute inflammations, or chronic catarrh may result from such a condition.

Some persons are susceptible to certain kinds of irritants, whether it be a particular kind of dust, a particular kind of pollen from plants, or the emanations or odors from stables, horses, etc. If this susceptibility

is in excess, or occurs at certain times of the year, the patient becomes a so-called hay-fever or rose-fever sufferer, and then shows symptoms of anaphylaxis.

The pathology of any acute mucous membrane inflammation is divisible into stages, the first being that of congestion and dryness of the surface. With this congestion there is swelling due to dilatation of the blood-vessels and more or less erection of the tissue, and with this swelling, if the mucous membrane is in a narrow canal, there is more or less obstruction, with discomfort, or even pain.

The next stage of the mucous membrane inflammation is the outpouring of a more than normal amount of mucus. The surface of the membrane then becomes moist, and the pain or discomfort becomes less as the tissues become less congested, owing to more or less extravasation of watery secretion and white blood-corpuscles which sooner or later may become pus. This extra secretion is propelled by gravity or by cilia or by voluntary expulsive methods to some external orifice, and the patulency of the part gradually returns. If this inflammation persists the secretion becomes more and more purulent. With a good outlet, and where the irritating and purulent secretions are not too long retained, the tendency of the mucous membrane is to recover, the pus gradually disappears, the secretion becomes mucopurulent, then mucus but in an abnormal amount, and finally the mucous membrane becomes normal, with its normal amount of mucous secretion. However, for some time this membrane is more susceptible to recurrences of inflammation.

The mucous membrane of the nose and throat in some persons may become abnormally dry. This condition is more difficult to treat, and even prolonged treatment may not cause it to become normal. Such persons have what is termed dry catarrh, and unless great care is taken, retain dry strings or plaques of secretion that putrefy and cause a disgusting odor to the breath, a condition termed ozena.

With a localized acute inflammation of the mucous membrane there may or may not be fever, depending on the susceptibility of the individual to an irritation, some persons developing fever readily, others having no fever except under serious provocation.

Applying this pathology to an acute coryza, it is readily understood, with a damming up of the passages from congestion and secretion, that germs, both by their own movements and by pressure, may migrate or be forced into some of the sinuses surrounding the nostrils, and the frontal sinuses are those that most frequently suffer. This is the cause of the frontal headache from the congestion which occurs with most colds, and of an actual frontal sinusitis when infection actually enters these regions. If the same inflammation occurs in the nasopharynx, the mouths of the eustachian tubes may become blocked, and middle ear congestion from aspiration of the air is caused. Also the germs of infection may migrate up these tubes and middle ear inflammation develop.

Treatment

The preventive measures have already been referred to and described. They consist of proper bathing to keep the skin in good condition; proper clothing, depending on the region, season and exposure; proper heating and ventilation of living rooms, bedrooms and buildings in which persons are employed, and in the case of the child, proper heating and ventilation of the schoolrooms. As previously stated, a child may be overclothed for play, as well as underclothed for sitting in cool rooms. The child should be extra well clothed, if he attends an open-air or open-window school during the cold seasons; such schools probably are among the greatest means of prevention of coryza, sore throats and coughs. On the other hand, the too severe exposure of young children and babies to dampness and winds is inexcusable and does not increase their resistance against catching cold, and often precipitates more

serious conditions. Any person who has a tendency to nasal or pharyngeal colds should not suffer undue exposure at night. Too many windows being open may cause too much direct draft over the face. Fresh-air sleeping should be governed by common sense. Cold daily sponging of the child's face, neck and chest, followed by quick friction, is a splendid means of decreasing the likelihood of catching cold or becoming chilled. Older persons may take cold showers or cold plunges in the morning, if it is advisable in individual cases.

To repeat, it is urged that while most acute colds, if not all, are probably due to germs, still acute congestion and more or less nasal secretion may be caused by drafts or currents of cold air causing chilling of some uncovered surface of the body, especially if the person is overheated or is perspiring from exertion or from being in an overheated room. This congestion forms a splendid culture ground for the development of germs.

Children especially should not be subjected to unnecessary infection by being taken into crowded cars, stores or into various assemblages, where it is impracticable to avoid close contact with coughing or sneezing persons who do not properly protect the surrounding atmosphere by using handkerchiefs.

Schoolchildren with acute colds should either be sent home or should be taught to prevent spraying the atmosphere with droplets of infection and thus infecting surrounding children. If a case of acute coryza occurs in a family, the family should understand that it is contagious, and the sick should be isolated from the well as effectively as practicable.

As so many times urged, a child or adult who has repeated colds should be examined and properly treated medically or surgically by a nose and throat specialist. The family should also be taught that the exchange of handkerchiefs and the use of the same towels when one member of the family has a cold or sore throat is inexcusable. Direct contagion by this method is probably

very frequent. During all colds the nasal and throat secretions or excretions should be received into paper handkerchiefs, or pieces of cheese-cloth, and either immediately burned or deposited in a paper bag for burning later. If handkerchiefs are used, they should be washed separately and soon.

The harm which a too dry indoor atmosphere can do to mucous membranes of the upper air passages is well described by Wolff Freudenthal.[1] The drying of these mucous membranes caused by evaporation due to the inhaling of too dry air leaves the membranes unprotected, and the first irritant that attacks them may cause an inflammation. It is necessary, therefore, to teach and advise that more moisture be furnished the air of all houses, buildings, schoolrooms, churches, theaters and other places of assemblage.

By all of these methods the frequency and number of nasal colds will be greatly diminished.

Acute coryza having begun, an attempt should be made to abort it. There are various methods of relieving internal congestions, and the general principles are the same in all cases, wherever the localized inflammation may be. These general methods are some means to reduce an increased temperature, some means of bringing the blood to the surface of the body and increase perspiration, some means to produce free catharsis and thus to deplete the blood-vessels and lower the blood-pressure to relieve indirectly the tension in the region of congestion, and some means to prevent the development of the second stage, or stage of secretion, if possible. Methods used to meet one of these indications will many times meet one or more of the others; hence the treatment is often very simple.

If the patient is first seen in the morning, or before the middle of the afternoon, the best treatment is a saline purge of some description, as exemplified by the Seidlitz powder or by the effervescing magnesium citrate or Rochelle salt, or castor oil if that is preferred.

1. Freudenthal, Wolff: New York Med. Jour., Jan. 3, 1914, p. 1.

If the patient is seen first in the evening, a less quickly acting cathartic is advisable, and none is better than a small dose of calomel, as from 0.05 to 0.20 gm. (about 1 to 3 grains), depending on the age of the individual, combined with 0.50 to 1 gm. (7½ to 15 grains) of sodium bicarbonate. Or, 1 grain of calomel may be given with an ordinary compound aloin pill or tablet. The old-fashioned Dover's powder is still given by many physicians and often works well, but may cause considerable nausea. Also, opium or morphin in any form tends to inhibit free action of the bowels, which is undesirable. One of the best treatments is one of the coal-tar products, such as antipyrin, acetanilid or acetphenetidinum. Any one of these may be given in one fair-sized dose or in two medium-sized doses, or in several small doses. One gm. of antipyrin would be a full dose; 0.50 gm., repeated in five or six hours, would be a medium dose; 0.30 gm. of acetanilid would be a large dose, and 0.10 gm. might be repeated at three-hour intervals for three times. A satisfactory method is a combination of acetanilid with sodium bicarbonate, and a prescription similar to the following is often very valuable:

		Gm.		
℞	Acetanilidi	0|25	or	gr. v
	Sodii bicarbonatis.....	2|50		gr. xl

M. et fac chartulas 5.
Sig.: One powder every two or three hours.

A similar combination may be given in tablets, if preferred. It should be remembered that caffein has been shown not to protect the heart from depression caused by large doses of a coal-tar product; therefore, there is no object in adding caffein to such a prescription. When these coal-tar products are ordered, it is well to give coincidently hot lemonade. Perspiration is more readily caused by this means.

Provided the patient is not soon to be subjected to exposure, a hot bath is another efficient means of relieving internal congestions, and can be used coincidently with the other treatment. Acidum acetylsali-

cylicum (aspirin) is now more largely used than almost any other drug to abort colds. The laity, on account of the instruction which they have received of the dangers of acetanilid and similar drugs, now all buy and use this drug with the greatest freedom. It can cause cardiac depression, and should not be used *ad libitum*. If preferred, it may certainly be ordered.

Rhinitis tablets are sold everywhere to the laity, and are largely used by physicians. These are various combinations of morphin, atropin, strychnin and aconitin. The minute dose of aconitin ordered probably generally has no action. If one desires the activity of aconite, it is best to give it in a tangible form and dosage, namely, the tincture of aconite, a drop perhaps every half hour or hour, until the pulse shows the activity of the drug. However, this treatment ordinarily requires that the patient be seen within a certain number of hours by the physician, to ascertain whether or not the aconite should be stopped, unless the doses are limited in number. The old aconite treatment of colds has mostly given place to the newer treatments described above. The whole rhinitis tablet combination probably represents principally the action of atropin with some help from the morphin, both of which will dry up the secretions of the nostrils and throat. The small amount of strychnin probably is not very active. Sometimes minute doses of quinin enter into these combinations, but that probably is not active. In other words, it is a question if a small dose of atropin sulphate, given frequently, does not act as well as one of these rhinitis combinations.

There is no question about the drying up of secretions by morphin, if this drug is pushed. Rarely is such treatment needed. The old-fashioned treatment of a hot foot-bath, a hot whisky punch, and the patient put to bed is a treatment that is often successful. The upper air passages and the head are relieved from congestion by such treatment, the blood-vessels of the surface are dilated by the alcohol, and the patient per-

spires more or less and the treatment is conducive to comfort. In this age, however, when other vasodilators are accessible, it is rarely necessary to resort to alcohol.

Quinin sulphate has been used for years as an abortive treatment of colds, and the laity, until more recently adopting acetylsalicylic acid, have always resorted to this drug. Small doses would probably not have any very decided action; large doses are inadvisable at this stage of the congestion because of the tendency to congest the middle ear.

Spraying or snuffing solutions into the nostrils at this stage is inadvisable. The throat may be gargled with warm physiologic saline solution, which is roughly represented by ¼ teaspoonful of salt to half a glass of warm water. If the patient has been known to be exposed to some acute throat or nasal infection, more active antiseptic gargles and sprays may be used; but an acute coryza will rarely be aborted by local treatment.

If the inflammation is not aborted and the second stage develops, that of profuse mucus and some mucopurulent discharge, then cleansing of the nose and throat becomes urgently needed. At this stage all of the foregoing abortive measures should cease. A patient who has been more or less deprived of food, except a small amount of liquid nourishment for from twenty-four to thirty-six hours, may now resume his normal diet.

The more or less purulent discharge from the nostrils should not be allowed to remain blocking up the passages. Consequently, atomizing with warm saline and alkaline solutions should be more or less frequently done. Various compound solutions or tablets for solution are offered, but there probably is no advantage in these combinations over more simple ones. The simplest cleansing solution is one made from ½ teaspoonful of salt and ½ teaspoonful of sodium bicarbonate to a glass of warm water, or half these amounts for

half a glass of water. To be properly soothing, the solution should always be warmed. The same solution may be used as a gargle. If a mild antiseptic is needed, saturated solutions of boric acid or borax are efficient. If stronger antiseptic solutions are required or advisable, hydrogen peroxid is valuable, as 1 part of the official aqua hydrogenii dioxidi to 4 or 5 parts of warm water for a gargle, or 1 part to 7 or 8 parts of warm water for a nasal spray. Nasal spraying and proper cleansing of the nose protects the adjacent sinuses from infection.

Cleansing the nasopharynx by snuffing back a solution from a teaspoon or a small vial, or snuffing back a spray, or gargling and then throwing the head forward and washing the nasopharynx, protects the eustachian tubes from infection. Two cautions should be suggested: first, that douching of the nasal passages should not be done with the nostril blocked, or with a high placed douch reservoir, as the pressure is likely to be sufficient to send fluid into the eustachian tubes or into the sinuses, and cause inflammation of such parts. Most of the patented douch apparatus are inadvisable. The second precaution is that it is not well to cleanse the mucous membrane of the nostrils too thoroughly of mucus before the patient goes into the outside air, especially if that air is dust-laden. The proper time to spray is when the patient is to remain in the house for a short time; or if he is sprayed and then must go out of doors, he may receive a non-irritant oil spray to furnish a coating for the mucous membrane, this to be used after the alkaline spray. Or a small plug of cotton may be placed in the nostrils.

If the secretion from the nose is tenacious and hard to dislodge by blowing the nostrils, ammonium chlorid may be a drug of value. It has been used as a stimulant to the upper air passage mucous membrane as well as to the bronchial mucous membrane. It may be given in a simple preparation as:

	Gm. or c.c.		
℞ Ammonii chloridi.....	5		ʒ iss
Syrupi acidi citrici.....	25	or	fl.ʒ i
Aquae.....q. s. ad	100		fl.ʒ iv

M. et Sig: A teaspoonful, in water, every three hours.

If the coryza tends to become subacute and prolonged, tonic treatment is required; a small dose of quinin and a small dose of iron, with or without arsenic and strychnin, are advisable. Or calcium glycerophosphate may be given in doses of 0.30 gm. (5 grains) in capsule, three times a day, after meals. The following tonic capsule may be used, and the doses may be modified for a child:

	Gm.		
℞ Arseni trioxidi.....	0.04		
Strychninae sulphatis.....	0.04		*aa* gr. ⅔
Ferri reducti.....	1.0	or	gr. xv
Quininae sulphatis.....	2.0		gr. xxx

M. et fac capsulas siccas 20.

Sig.: A capsule three times a day, after meals.

If the mucous membrane of the nose and throat does not return to health, and the secretion of mucus does not seem to be sufficient, a great promoter of secretion is an iodid, and the best salt is the sodium iodid. The dose required is not large; 0.10 to 0.20 gm. (1½ to 3 grains) three times a day, is generally sufficient.

Various menthol, camphor and pine oil preparations are used as sprays or applications for the nostrils, sometimes with good results, or as inhalants when the nostrils tend to become closed and cause discomfort by occlusion. Such treatment has its use at times. Spraying with suprarenal solutions is sometimes of advantage, but sometimes is followed by more congestion. Some nose and throat specialists use suprarenal preparations constantly. Such treatment certainly many times is efficient in temporarily relieving congestion and giving comfort.

This discussion of the treatment of common colds would not be complete without reference to the vaccine treatment. While the exact value of such treatment has not been determined as an abortive treatment or as

a treatment that shortens the course of the disease, the enthusiastic recommendation of such treatment by some writers should be recognized. When there is sinus infection, autogenous vaccines would seem indicated.

An interesting paper on the subject of vaccine treatment of common colds, including considerable bibliography, is that of Dr. Jessie W. Fisher.[2]

ACUTE PHARYNGITIS

The abortive treatment of this inflammation is the same as that described for acute colds; but if a child is discovered to have a sore throat, a swab should be sent to the board of health for examination, and the child should be immediately sent home, lest diphtheria or scarlet fever be the cause of the condition.

With a simple pharyngitis, soothing alkaline gargles, as previously described, should be the treatment. A very simple, pleasant and efficient gargle is as follows:

	Gm.		or c.c.
℞ Acidi borici.....	2		ʒ ss
Potassii chloratis.....	5	or	ʒ iss
Aquae menthae piperitae...	200		fl.ʒ vii

M. et Sig.: Use undiluted as a gargle, every three hours.

COUGHS

Before discussing the infections of grip and whooping-cough, it may not be out of place to refer to the varying kinds of cough. The trained nurse at the school, if not the teacher, should be able to note and describe the character of a child's cough to the medical inspector. Only by careful observation can the early stages of whooping-cough be suspected and discovered.

Coughing is an expiratory effort caused reflexly by some irritation. The muscles of the lower part of the chest are most engaged in the act of coughing; hence in severe, prolonged or frequent coughing muscle tire occurs in the lower part of the chest, both anteriorly

2. Fisher, J. W.: Boston Med. and Surg. Jour., June 5, 1913, p. 834.

and posteriorly. The abdominal muscles all take part in this expiratory effort, and the erector spinae muscles, the serratus, and the quadratus lumborum are all utilized in a strong expiratory cough. These muscle contractions compress in all directions the lower part of the chest, and the air in the bronchial tubes is forced upward, and if there is no obstruction is expelled through the glottis. If there is obstruction, or even partial obstruction, the upper portion of the lungs, especially the apices, become dilated, and temporarily, or in severe cases, permanently, emphysematous.

Cough can be caused by irritation of any of the mucous membranes of the air tract, by irritations of the nerves in the lung tissue, by irritations of the pharynx, by reflex irritation of the vomiting center, and by any irritation that can reach, through the pneumogastric nerve, the center in the medulla. From any of these reflex causes efferent impulses are transmitted, and the result is a cough. Irritation in the nose and ear may cause cough.

Pain and muscle tire from prolonged coughing, besides occurring in the lower part of the chest, occur in the sides, low down, perhaps in the region of the insertion of the diaphragm, and also in the back even down in the lumbar region. These strong contractions of the abdominal muscles during coughing also aid in temporarily diminishing the capacity of the thorax by pushing upward the abdominal organs. At the same time there is a considerable force exerted downward, which may tend to cause uterine displacements, hemorrhoids and even involuntary urination.

Before this forcible expiration or cough there is generally a deep, quick inspiration; then the glottis is partially closed and the air is propelled upward forcibly, causing friction which tends to expel anything on the walls of the mucous membrane of the bronchial tubes and trachea. Even in simple bronchitis, if there is much coughing, there will be found increased

resonance in the apices of the lungs, as there is probably always a temporary emphysema.

Nasal irritations may produce cough as frequently as they cause asthma. Irritations of the nasopharynx and pharynx proper frequently cause coughing, which is very likely to be accompanied by retching and even vomiting. An elongated uvula may tickle the epiglottis and cause spasmodic, quick expiratory coughing. This cause, however, is rare compared with the frequency of cough caused by an enlarged lingual tonsil, whether the tonsil is hypertrophied, contains dilated blood-vessels, or is inflamed. Any disturbance of this gland or lymphoid tissue may cause a tickling in this region sufficient to produce a very irritating and disturbing dry cough, which comes on sometimes in paroxysms, until a certain amount of mucus is literally scraped off. The very intensity of the cough so irritates the part, like scratching a spot on the skin that itches, as to stop the tickling sensation for a time. Irritations of the larynx almost always cause cough. Hence no examination of a patient who coughs is complete without a throat and larynx observation.

The dry bark of spasmodic croup is very characteristic. The noise is low pitched, and is a bark. If it is husky there is mucus or membrane present.

The cough of bronchitis can be of all descriptions; it may be dry, may be non-productive, and may be moist and productive. Pain in such cough (the same is true of grip) is referred under the sternum, and is due largely to the vibrations of the air causing pain to the inflamed mucous membrane of the trachea and perhaps larger bronchi.

The cough of pneumonia is at first somewhat painful, and the pain is referred to the side, near the nipple. This cough may be at first dry, but is soon productive and generally should be encouraged.

The cough of pleurisy is non-productive and undesired, and is never loud. It causes pain referred to the side, and is repressed by the patient. There is

nothing to expectorate, and it should be discouraged and stopped.

The cough in the first stage of tuberculosis is often dry and catchy; it is a hack. There is no great intensity to this cough, and no necessity for it, and it should be discouraged. As soon as there is much local bronchial catarrh the cough should, as it is then productive, not be discouraged, except at meals, and in the presence of others; that is, such patients should be taught when to cough.

The cough of asthma is a wheezing affair and accompanied by all sorts of rattlings; the same type occurs in a stuffy, asthmatic bronchitis. This cough is generally not harsh.

The coughs of different individuals vary. Some always cough with great intensity, and others easily and lightly. Older persons seem to raise mucus and pus from the bronchial tubes with difficulty. It takes a great many coughs to raise the sputum for expectoration. Young children generally cough easily, but generally swallow their sputum. Very weak patients will hardly expectorate at all. In such cases the foot of the bed may be raised at night; also when they cough, while in bed, they should turn onto the side or stomach in order to raise the sputum, or they should lean over in order to have gravity aid as much as possible the expulsion of the mucus, etc. The cough of pertussis occurs in showers or paroxysms, and at the height of the disease the glottis closes during inspiration and the air is sucked in through a more or less narrow slit, giving the characteristic "whoop."

Persons coughing very hard, as typically in whooping-cough, but also in emphysema and in the severe bronchitis of strong, sturdy men, will cause a great deal of cardiac disturbance by retarding the flow in the large vessels of the thorax, thus increasing the work of the heart, especially of the right side. Such coughing can force backward the blood in the large

veins, thus congesting all the organs, notably the eyes, face and head, and whooping-cough can cause a cerebral hemorrhage or a hemorrhage into the eyes. These patients may not infrequently have nosebleed, and even vomit blood.

ACUTE BRONCHITIS

A child with an acute bronchitis, with expectoration, whether with or without fever, should generally be sent home; or if he is not acutely sick and continues to attend school, he certainly should be watched. There is no question that, whether bronchitis occurs in an adult or in a child, the patient will recover more quickly if he remains in bed for one or more days.

The prophylactic treatment is the same as for an acute coryza, and these treatments will more or less relieve the congestion in the bronchial tubes and promote expectoration, if the disease is not aborted. The cough is at first non-productive, but as soon as mucus begins to be plentifully expectorated the cough is productive, the tightness in the chest is relieved, and the patient feels better. One of the best promoters of a free mucus secretion is ipecac, and a few drops of the syrup of ipecac, given every hour, unless nausea is caused; or from 0.03 to 0.05 gm. (about ½ to 1 grain) of the powdered ipecac may be given every two hours. The ipecac should never be pushed to the point of causing uncomfortable nausea. The dose should, therefore, as suggested, be very small.

In the second stage of bronchitis there is no expectorant that seems to work so well as ammonium chlorid, and the dose should be about 0.25 gm. (4 grains) every two hours. The bad taste of this drug may be well covered up by giving it in a sour mixture, as the syrup of citric acid and water. If the cough is excessive and more than the secretion calls for, there is possibly no better method for its control than to give small doses of codein sulphate. This may be combined with the ammonium chlorid in a sour mixture, as:

		Gm. or c.c.		
℞	Codeinae sulphatis.....	0	20	gr. iv
	Ammonii chloridi.....	5		ʒ iss
	Syrupi acidi citrici.....	25		fl.ʒ i
	Aquae.....q. s. ad	100		fl.ʒ iv

M. et Sig.: A teaspoonful, in water, every two or three hours.

This prescription is for an adult, but may be readily modified according to the age of the child. If the codein is not desired, it may be omitted. If it is desired to give the ammonium chlorid less frequently, the dose may be made larger. If a sweeter mixture is preferred, the syrup of tolu may be substituted for the syrup of citric acid; or both the syrup of citric acid and the water may be omitted and the syrup of wild cherry substituted.

If the larynx is inflamed, the inhalation of simple steam, or various other inhalants, may be of value, but a patient with laryngitis of any type should be under very careful observation by a physician.

If the expectoration becomes more profuse and seems not to stop readily, terpin hydrate seems to be of value. The dose is 0.30 gm. (5 grains) about four times a day. This may be given in tablet or in powder; solutions are unsatisfactory as it is very insoluble. If deemed advisable it may be combined with codein or heroin in small doses. There is, however, no real advantage in heroin over codein.

If the coughing persists longer than a week, the sputum should be examined to determine what germs are present. If it proves to be a simple bronchitis, but prolonged, sodium iodid in small doses may be of value, especially if the patient is at all asthmatic, or if it is in an older person. Fresh air, good food and iron are always of value in curing all kinds of bronchitis. If the patient is a child and the nutrition is poor, cod-liver oil is good treatment. A bronchitis that will not stop must be treated as a pre-tuberculous stage of tuberculosis, and the patient should receive climatic, or open air rest cure treatment.

It should be emphasized that a patient with bronchitis is not properly supervised unless the temperature is taken, and this more or less frequently. A patient with a fever should remain at home, if he wishes to avoid complications that readily occur from an acute bronchitis or grip. The district nurse or the medical inspector should always take the temperature of a coughing child. If a child has any fever, it should be sent home and the family physician summoned.

ASTHMA

As previously mentioned, a child in school that is found to be asthmatic should be carefully examined by the medical inspector and referred to the family physician, and if necessary, to a nose and throat specialist, to determine whether or not there is a reflex cause, and to have this cause removed if possible. The asthmatic habit once well acquired is difficult to cure.

INFLUENZA: GRIP

Since the last epidemic of this disease in the United States in the winter of 1889 and 1890, there has been no year without the disease occurring in many parts of the country. In some regions it is present for months, sometimes occurring in small epidemics, at other times in isolated instances. Were the air-passage secretions to be examined in every case of cold and bronchitis, the influenza bacillus of Pfeiffer, discovered by him in 1892, would frequently be found.

While the well-known acute epidemic types of this disease probably always show this bacillus, it is not always discovered in instances that seem similar and are well termed grip or influenza, as distinct from an ordinary cold or bronchitis. Whether another distinct germ causes an inflammation of the air passages simulating influenza (that is, a closely related germ), or whether it is the same germ that has become so attenuated and changed that it is not recognized, has not

been determined. To all intents and purposes, clinically and practically, these isolated cases without the true Pfeiffer bacillus should be considered as serious as though that germ were present and should be treated the same, as all of these cases seem readily to develop pneumonic conditions.

The toxin produced or elaborated by the influenza bacillus seems to be a vasomotor depressant, and perhaps acts through the sympathetic system. The small blood-vessels all over the body seem to dilate and produce capillary congestion, especially of the mucous membranes, the most frequent result being a coryza, a pharyngitis, a laryngitis or a tracheitis. The congestion in the larynx causes the harsh, dry, metallic cough which is quite characteristic of this type of influenza. The congestion and swelling of the mucous membrane of the trachea causes a peculiar oppressed feeling, with more or less pain, referred to the upper part of the sternum. The great amount of sneezing which occurs with a typical attack, almost similar to hay-fever, is due to congestion of the mucous membrane of the nostrils. The conjunctivae may also be injected, causing pain in the eyeballs and often a serous conjunctivitis, another typical symptom of influenza. In some seasons there seems to be a special tendency to middle-ear inflammations. At other times there frequently occurs a congested drum, with sometimes a hemorrhagic bleb or vesicle on the drum, a very painful though easily remedied condition.

The almost constantly present lumbar backache at the onset of this disease is probably due to congestion of the kidneys, and albumin is frequently found in the urine of such patients, and occasionally blood-corpuscles. A menorrhagia or a metrorrhagia may occur from the same tendency to dilatation of the blood-vessels. There may even be nosebleed, and occasionally a slight hemoptysis without any other assignable cause and without any subsequent development of

tuberculosis or any other disease. With this disease, although the fever may be high, the skin is likely to be moist, and there may be profuse perspiration. The pulse may be slower than we normally expect from the height of the fever, and the blood-pressure is generally lowered; all of these conditions are due to the tendency of the blood-vessels to dilate. This dilatation of the vessels on the surface of the body, with the increased radiation and evaporation, causes the beginning high temperature of typical influenza to be short-lived, although for some days the temperature may rise regularly every afternoon and evening to a gradually decreasing degree.

The heart is generally weak from start to finish in this disease, and even collapse turns can occur. Also, during the first year of the last epidemic many persons were shocked by the disease and collapsed, having no fever and showing no symptoms except a weakened heart and circulation. This is the typical nervous type of the disease. The disease may also cause cerebral symptoms without many catarrhal symptoms, and sleeplessness, irritability and headache are very constant symptoms in all forms of grip; even meningitis can occur from this germ.

Rather an infrequent type of the disease is the bowel type; this can occur without respiratory catarrhal symptoms. Patients so affected have diarrhea, with more or less intestinal irritation, apparently the greatest amount of dilatation of blood-vessels in these cases occurring in the mucous membrane of the intestinal tract. These various types, the catarrhal, the nervous and the abdominal, may be interwoven, and a patient may show symptoms of all three.

The future of every case of influenza is prostration, nervous and muscular debility, with more or less circulatory weakness; in other words, there is exhaustion. The patient's resisting power is reduced, and any defect or diseased condition that he may have is aggravated by an intoxication with this germ.

If no complications occur, the convalescent patient should rest as much as possible, should not be subjected to exposure and should be given tonics, and, if necessary to cause restful sleep, for a short period at least, some hypnotic or some physical method of causing sleep. The most frequent complication is pneumonia, and the type of pneumonia that the influenza germ seems to cause most frequently is the lobular or bronchial pneumonic type; pneumonic congested areas may be found in different parts of one or both lungs. Not infrequently, however, true lobar pneumonia occurs.

The next most frequent complication, as suggested above, is middle-ear catarrh. The various sinuses in the region of the nostrils may become affected; all types of indigestion may occur, and not only sleeplessness and meningismus, but also a very serious meningitis, and even insanity can be caused by these germs and their toxins. Mental depression is a common occurrence, following severe attacks of grip. Pericarditis and endocarditis occur as complications of influenza.

It is thus seen that this disease should always be taken seriously, and every possible means used to prevent contagion, as it is one of the most highly contagious diseases. It spreads with great rapidity, but only by contact, although it may doubtless be transmitted by infected clothing, and perhaps even by letters, as when the last epidemic first reached America, the first persons affected in many cities were post-office clerks.

While no season is exempt from this disease, it occurs most frequently in colder weather, and in the colder climates, and in moist climates. Perhaps the more sunshine, the less frequent the disease. While one attack may protect a person for that season, he seems more susceptible to subsequent attacks in following years. There are doubtless many carriers of

this disease who may have a persistent and continued subacute or chronic catarrhal infection and very likely are distributers of the disease to others. When one case occurs in a household, other members of the family become readily infected. The same is true in schools and in stores or buildings in which an infected person is closely associated with others. Many an office with one employee affected will soon, on investigation, show every other employee to be more or less seriously affected. While almost all persons are susceptible to this disease, a few seem to be immune. It is the most frequent of all definite infectious diseases.

TREATMENT

It having been determined or suspected that a patient has influenza, it is much more important that he remain in bed, or at least in the house, than if he has an ordinary acute cold. Also, it is more essential that he be more or less isolated or that measures be taken that he does not spread the disease by spraying from coughing or sneezing, and that he does not use the same towels, napkins, drinking-cups and eating utensils as other members of his family. The patient should be prohibited from fondling and kissing children. If the patient is a young child in close contact with the mother or nurse, all possible precautions to prevent contagion should be taken.

In a word, each family should be taught that grip is an infection, that it is contagious, that it spreads rapidly, that it may have serious complications and that it frequently leads to pneumonia, which has become in many regions of this country the most frequent cause of death. Therefore, even an apparently mild case of grip or influenza should be treated actively and energetically. As previously stated, whether a schoolchild begins with an acute cold or an influenza, he should be sent home and remain there until he is well, or at least almost well.

As a grip patient is liable to have a chill, or at least feel chilly or have cold sensations up and down the back, anything that makes him warm improves his condition. He may be given hot malted milk, hot tea or hot lemonade, at more or less frequent intervals, until his chilliness has ceased. The patient may be given a hot tub bath and then put into a warm bed in a warm room as an efficient means of making him comfortable and relieving his internal congestions. Hot water bags at the feet and extra coverings to the bed are often needed. A quickly acting stimulant is aromatic spirits of ammonia, given in half teaspoonful doses in hot water or hot lemonade, at intervals of three hours, for three or four times. The various methods suggested for aborting an acute cold may be used in this disease. Much greater care must be exercised, however, if the patient has the influenzal infection than if he has a simple cold, as to when he can return to his work or occupation, or be subjected to exposure to cold or dust, either in a house, building or outdoors.

As soon as the patient feels warm, the temperature may rise quite high, associated with severe headache, backache and irregular pains in other parts of the body. At this time a drug such as acetanilid, antipyrin, and that he is not to be subjected to exposure. With acetphenetidinum, or acetylsalicylic acid will be of benefit, provided that the patient is not ambulatory, this depressing infection such treatment is not wise unless a patient is in bed, or at least remains in the house.

The proper dosage of these drugs has already been suggested, and no one of them should be long continued. The most depressant is undoubtedly acetanilid, and perhaps the least depressant is acetphenetidinum. Should depression occur after one of these drugs has been administered or from the disease, circulatory stimulants such as aromatic ammonia, cam-

phor or caffein should be given and the patient surrounded with dry heat. A hypodermatic injection of strychnin sulphate, 1/30 grain, may be given to stimulate the nerve centers. Cyanosis has not infrequently been caused by acetanilid, but an amount of this drug large enough to cause such a condition should never be given. The following prescription may be suggested:

		Gm.	
℞	Acetanilidi	0|50	gr. viiss
	Sodii bicarbonatis.....	1|0	gr. xv

M. et fac chartulas 10.

Sig.: One powder, with water, every two hours, except when the patient is sleeping.

Or:

		Gm.	
℞	Acetphenetidini	1|50	
	Phenylis salicylatis.....	1|50	āā gr. xxv

M. et fac chartulas 5.

Sig.: One powder every three hours.

It should be remembered, as previously noted, that it has been shown that an alkali like sodium bicarbonate inhibits the undesired action of coal-tar drugs on the heart; also, that caffein does not protect a heart from undesirable activities of the coal-tar drugs; in fact, it has been shown to intensify such activity.

In making a diagnosis of the infection present it is well to remember that any of these drugs, and also salicylic acid in any form, may cause eruptions on the skin, either erythematous or urticarial.

But little food is needed during the first twenty-four hours of grip, and it should not be pushed even on the second day, if food is repugnant to the patient. He should have plenty of water and such simple liquid nourishment as he desires. As soon as the appetite returns, food should be pushed. The various catarrhal conditions should be treated as suggested under coryza, pharyngitis and bronchitis. Also, while the patient is kept warm, he should have good fresh air in his room. This is essential with all infections, and especially with infections of the nose, throat and lungs. The bowels should be treated as indications call for. Simple

laxatives may be given, if needed, or the soothing bismuth subcarbonate, if there is intestinal inflammation. Phenyl salicylate (salol) may be given, if there is much fermentation in the bowels, or the Bulgarian form of lactic acid bacilli may be given for a few days.

As soon as the patient begins to convalesce, he should be given tonics, and if there is no inflammation in the ears, quinin is valuable. Some form of iron should generally be given, and possibly a bitter tonic before meals. If the patient is not nervous, a small dose of strychnin three times a day is good treatment. On the other hand, it should be urged that strychnin stimulation is overdone, and a patient who cannot sleep should not be given strychnin or quinin later than the noon meal. Sometimes the sleeplessness following influenza is benefited by the administration of one-half to one teaspoonful of good fluidextract of ergot, taken an hour before bedtime. These patients should never be allowed tea or coffee after the noon meal, as they are very susceptible to cerebral stimulation by caffein and are likely to remain awake for hours from such stimulation. All disturbances or diseased conditions left over by grip must be treated energetically, else they tend to be prolonged. There are few germs that seem to be so tenacious and persistent, at least in their unpleasant results, as is the influenza bacillus. All persons are susceptible to serious consequences from influenza.

A schoolchild's desk, pencils, etc., and immediate surroundings should be thoroughly cleaned after the child has been sent home with an acute cold of any kind. This is especially necessary in cases of influenzal infection.

HOOKWORM DISEASE
(*Uncinariasis*)

This disease is found in all tropical and southern temperate zones; in the United States southward from the Potomac River latitude through to the Pacific coast. The symptoms are laziness, lassitude, weakness, loss of physical and mental ability and vitality, loss of weight and anemia. Children do not properly grow and adults become shiftless, incompetent, and poverty stricken, and they, with their families, become a tax on the community. Hence hookworm eradication is an economic question.

Hookworm disease is said to go back to ancient Egyptian times, but the parasite was not found until 1838, by an Italian; its relation to anemia was not discovered, however, until 1877, by Grassi and Colomiatti. It was named *Ankylostoma duodenale.*

The hookworm was discovered in Porto Rico by Major Ashford, Surgeon of the United States Army, but to Dr. C. W. Stiles of the United States Public Health Service belongs the honor of having found the worm in the southern states and of having shown that it differs generically from the Old World worm, but that it causes the same symptoms. The American type of worm is called *Necator americanus.*

Not to go into the life history of this parasite, suffice it to say that it may live in large numbers in the intestines of human beings for years, not only feeding on the blood and using up its nutriment, but biting the intestinal walls and causing hemorrhages, and by both means producing a progressive anemia. Eggs from these worms pass off with the feces, grow into minute larvae in the soil so contaminated, enter another human intestine, rarely by means of infected

food such as uncooked vegetables and fruit. In the majority of cases the larvae pierce the skin of the leg or other part exposed to contaminated feces and reach the intestine. In this way a barefooted child or adult may acquire infection through exposure of his feet.

The excrement of carriers of the disease must never be allowed to infect the soil. Also every carrier must be discovered, and it is the duty of each community to discover and treat every carrier within its confines, and even to be suspicious of visitors.

The establishment of sewerage systems in cities should eradicate the disease from those localities. Compelling the erection and use of sanitary privies, be they ever so inexpensive and simple, is another necessary preventive measure outside of sewered towns. An old-fashioned privy, wherever found, should be abolished. Its odors are offensive, it breeds flies and contaminates the soil, and the drainage may reach water-supplies. A privy to be modern and sanitary should be properly ventilated and well lighted, but thoroughly screened with fine-mesh copper wire, to prevent flies and mosquitoes from entering the building. The building should be firmly cemented to the foundation; there should be no leaks or openings. There should be a hinged door in the rear, opening under the seats for cleaning purposes. The seat covers should be self-shutting. The excreta should be received into a water-tight box or pail, and whether the wet or dry system is selected is a matter for the decision of the local health authorities. Just what disinfectants shall be used, chlorinated lime, or phenol (carbolic acid) solutions, or some oil that repels flies and other insects, is also for the decision of the local board of health. The sanitary privies recommended by the United States Public Health Service will be found described in United States Farmer's Bulletin 463.

Another preventive of infection by hookworm is to insist that shoes be worn in all infected regions.

The disease can be discovered by giving the specific treatment in a suspected case and then sifting or washing the stools through cheese cloth, when worms will be found, if present.

The treatment is to give little or no supper, and at bedtime a dose of magnesium sulphate. In the morning, as soon as the bowels have moved freely, one-half the dose of thymol, in capsules, is given, and in two hours the remainder of the thymol. Two hours later another dose of magnesium sulphate is administered. After movements of the bowels from this dose food may be taken, but only coffee or tea, without milk, should be allowed during the period of the treatment, namely, until the thymol has supposedly all passed out of the body. Absorption of thymol is not desired, as it may cause unpleasant symptoms. Alcohol and oils should not be given either before, during or even soon after the treatment. For one hour after taking the thymol the patient should lie on his right side to hasten the passage of the drug and liquid through the pylorus into the intestines.

The dose of thymol depends on the age, but is large. Ferrell[1] suggests 4 gm. (60 grains) for an adult dose (that is, from 20 years of age upward). Doses for children and youth may be readily estimated by the following formula, namely: At 15 years, ¾ of the age, ¾ of the adult dose; at 10 years, ½ the age, ½ the dose; at 5 years, ¼ the age, ¼ the dose; at 2½ years, ⅛ of the age, ⅛ of the dose. If the patient is much underweight for his age, the dose should be reduced accordingly. The thymol should be powdered and placed dry in capsules. One-half the dose decided on is given at 6 a. m. If the bowels have been well moved from the dose of magnesium sulphate of the night before, the other half of the dose

1. Ferrell, John A.: Hookworm Disease, THE JOURNAL A. M. A., June 20, 1914. p. 1938.

of thymol should be given at 8 a. m., both doses being taken with plenty of water. Ferrell adds sugar of milk in equal parts to the thymol, and says he thinks the drug acts better.

In one or two weeks the treatment should be repeated, unless the microscope shows the feces to be free from the parasite and its eggs. Sometimes a third and even a fourth treatment may be needed. The action of the thymol may be hastened by (at the moment of swallowing) uncapping the capsules.

Thymol when absorbed acts like phenol, but it is slowly dissolved by the gastro-intestinal fluids and hence, is absorbed slowly. Any oil or fatty substance hastens its absorption. Convulsions are probably not often caused by thymol poisoning, but great weakness and finally collapse are the gross subjective symptoms. Objective symptoms of its undesired absorption are albumin and even blood in the urine. Fatty degeneration of the liver and congestion of the kidneys and lungs are pathologic findings.

To forestall any possible great absorption of thymol after large doses are administered in hookworm disease, a brisk cathartic (Epsom, Glauber's, or Rochelle salt) should be given and repeated, if free catharsis does not occur within a few hours after taking the thymol. Castor oil, or any other oil, should of course not be the cathartic used. If symptoms of poisoning occur, stomach-washing, colon-washing, and sodium sulphate or potassium and sodium tartrate should be the means used to promote elimination. Strong black coffee should be given, and hypodermic injections of atropin, strychnin, and pituitary extract should be administered and the patient should be surrounded by dry heat. Later, any kidney congestion should be treated as an acute nephritis.

Except as a specific for hookworm, thymol should probably never be used internally. As a bowel antiseptic it is too dangerous a drug to be used repeatedly, unless the dose is too small to be of any value.

Ferrell's dosage for adults for hookworm disease is as follows:

	gm.
℞ Thymolis	4| or gr. lx

Fac capsulas siccas 10.

Sig.: Take 5 capsules, with plenty of water, in the early morning, as soon as the bowels have moved. Take the other 5 capsules in two hours. Two hours later take ½ ounce of Epsom salt, which should be repeated if it does not act in four hours.

Owing to a possible scarcity of thymol it is important to note that investigations of the United States Public Health Service have shown that oil of chenopodium (American wormseed oil) is efficient in this disease. (Public Health Reports, reprint No. 224, Oct. 2, 1914, by M. G. Motter.)

Wormseed oil seems to paralyze or stupefy rather than kill the hookworm; therefore it is very essential that soon after such action has occurred, a cathartic should be administered to cause evacuation of the worms before they can recover their vitality. Unlike male fern and thymol, castor oil may be administered with this drug. It will be remembered that any oil is likely to cause a dangerous amount of male fern and thymol to be absorbed. This is not true of wormseed oil.

The doses of oil of chenopodium suggested in this pamphlet are about 1 drop for every year of age up to fifteen. The drug is well administered in a teaspoonful of granulated sugar, every two hours, for three doses. Two hours later, a child of ten years, for instance, should receive a tablespoonful of castor oil with one-half a teaspoonful of spirits of chloroform. The dose of the castor oil and of the chloroform should vary according to the age of the patient.

Possible undesired symptoms from wormseed oil are drowsiness and depression. Such symptoms occurring, rapid purging should be caused by a saline cathartic, and such stimulants as hot coffee or caffein should be

given. The pamphlet suggests hot coffee by the rectum, but while purging is going on, this would hardly seem worth while.

The pamphlet further suggests that physicians using this wormseed oil treatment should keep careful record of their cases and report their results.

WHOOPING-COUGH

This infection, which most frequently attacks children, is generally regarded by the public as a trivial disease, and consequently proper treatment and means of prevention of infection of others are frequently not instituted. Even the medical profession for many years did not consider the disease serious, but better statistics, demonstrating the causative agent of death-dealing complications, have shown that whooping-cough is a dangerous disease.

The greatest mortality of whooping-cough is indirect. A large number of those infected die of such complications as bronchial pneumonia, capillary bronchitis, tuberculosis and a few from hemorrhages, while chronic debility, anemia, emphysema, and some lesion of the central nervous system are of not infrequent occurrence. According to the United States *Public Health Reports,* in 1910, whooping-cough had a mortality of 11.4 per hundred thousand deaths, while scarlet fever had a mortality of 11.6, measles 12.3, and diphtheria 21.4. In young children and infants, whooping-cough causes more deaths than measles, and some statistics show twice as many deaths as measles; 95 per cent. of deaths from whooping-cough occur during the first five years of life, and the majority of these during the first two years.[1] The conclusion is self-evident that babies and young children must not be allowed to acquire whooping-cough if it is possible to prevent it. If the deaths which occur from the diseases which follow as complications from previous whooping-cough were properly recorded as secondary

1. Morse: Whooping-Cough, THE JOURNAL A. M. A., May 31, 1913, p. 1677.

to whooping-cough, the seriousness of this disease would become even more evident than present statistics show.

There is no doubt that this disease is due to a contagium, and that this contagium is contained in the sputum and secretions of the upper air tract, and is transmitted to others by more or less close contact, either by droplets from spraying in sneezing or coughing, or by contact with infected handkerchiefs, napkins or bedclothes, or by contact with freshly sprayed or infected books, pencils, desks, chairs or eating utensils. Doubtless a frequent method of acquiring the disease is by kissing.

It is pretty well proved that the Bordet-Gengou bacillus is the cause of this disease. It seems to be established that the greatest infectivity occurs during the initial stages of whooping-cough, and that even during the active paroxysmal stage there is less liability of infection of others, and in the later stages there is probably no infective agent present. Some investigators even assert that a child should be allowed to return to school long before the paroxysmal stage is over, but that other children in the family of the child affected should not be allowed in school until it is shown that they will not have the disease. The disappearance of the infective bacillus and the consequent lessened danger of giving the disease to others seems to occur because some antibodies develop that prevent the further growth of the germ. It is certainly interesting that this contagious disease ceases to produce its contagium long before the symptoms of the disease have disappeared or the evident disease has ended. Whether or not this will be found true of scarlet fever and measles is of course not yet known, but it is markedly different from typhoid fever, pneumonia and diphtheria, in which the specific germs tend to persist a long time.

It has been shown that some domestic animals may be experimentally infected with whooping-cough; how frequently such animals become accidentally infected and are able to transmit the disease to children is not known. Probably, however, such a source of infection is rare. Kittens, puppies and monkeys have been experimentally infected with this germ.

Mallory and Horner[2] confirmed the opinion that the Bordet-Gengou bacillus is the cause of the infection of whooping-cough. This is a minute bacillus, occurring in large numbers among the cilia of the epithelial cells of the mucous membrane of the trachea and bronchi. It is stated that the germ does not grow above the larynx, although of course by coughing it reaches these parts. This germ is a small coccobacillus, and resembles the bacillus of influenza.

This disease is so readily acquired from one infected that some boards of health not only prohibit children who have it from attending school, but also prohibit their attending Sunday schools or public congregations, riding in public conveyances, playing in public parks, playing with other children on public squares, and from entering stores and theaters. Not to cause these children to be isolated in their homes, when fresh air is of great benefit to them, the boards of health of certain cities order that the child shall be tagged in some manner, perhaps with a button on which "whooping-cough" is printed in plain lettering. Just how carefully such ordinances will be carried out, and just how much they will reduce the frequency of whooping-cough, will be determined after full trial.

This disease occurs largely in epidemics, and young children and babies are apparently most susceptible to the disease. This may be more apparent than real from two reasons: first, because young children, necessarily remaining more in the house, are liable more

2. Mallory and Horner: Jour. Med. Research, November, 1912. Mallory: Jour. Med. Research, March, 1913.

frequently to come into contact with concentrated infected matter if an infected person comes near them, and secondly, because a large number of older children and the majority of adults have probably had the infection and have become immune. However, when an adult or elderly person acquires the disease it is almost invariably severe. The muscular strength of adults makes the paroxysmal coughing of much greater danger; they are more liable to emphysema, heart strain and hemorrhage. They are not so liable to have pneumonic complications. Whooping-cough, however, even in adult life, is a not infrequent stimulator of a latent tuberculosis. Often an adult, who is in close contact with a whooping-cough patient, and who may have had the disease in childhood, develops a mild form of the disease; at least they have the catarrhal symptoms and cough spasmodically occasionally. Whether the Bordet-Gengou bacillus is present in these cases has not been determined. It is a fact, however, that ordinarily one attack of the disease renders a person immune.

From the foregoing it will be seen how very important it is to make an early diagnosis of whooping-cough. While it is stated that the Bordet-Gengou bacillus may be generally demonstrated in true cases, a method termed the "complement-deviation" test is urged by some investigators. When positive, it is almost conclusive evidence of the disease being present, and when negative conclusive evidence that the disease is not present. Friedlander and Wagner[3] make the statement that in their opinion "the complement-deviation test is of the greatest possible value in the diagnosis at all stages." A description of the technic of this test is given by them.[3]

As both the identification of the Bordet-Gengou bacillus and this complement-fixation test require con-

3. Friedlander, Alfred, and Wagner, E. A.: Diagnosis of Whooping-Cough by the Complement-Deviation Test, Am. Jour. Dis. Child., August, 1914, p. 134.

siderable time and skilled technic, examination of the blood for leukocytosis is suggested as a quicker method of determining whether or not the disease is present. A small leukocytosis, from nine to ten thousand, may be present as early as the third day, while during the paroxysmal stage it may run up to sixty thousand or more. It has been considered that in a suspected patient a leukocytosis from fifteen to thirty thousand (other diseases that cause leukocytosis being excluded), combined with catarrhal symptoms and the opportunity for infection, would give presumptive evidence that the disease developing is whooping-cough. In this leukocytosis there is a relative increase of lymphocytes. It is stated that this leukocytosis may be more or less present for from two to three months, and that in the stages of improvement a mild eosinophilia is found.[4] While leukocytosis is generally present in whooping-cough, its diagnostic importance must always be modified by the possibility that some other cause of this increase in white cells is present. It should also be remembered that leukocytosis is often present in young children from various causes.

The incubation period of pertussis is not definitely known, and may vary from two to ten days; therefore before it is considered safe for a child exposed to this infection to return to school or to play with other children, at least ten days must have elapsed, and perhaps a better working rule is two weeks.

Pathologically, the disease manifests itself by a catarrh of the upper bronchial tubes, trachea, larynx and perhaps pharynx and nose. The secretion is mostly mucus, with perhaps, later, a mucopurulent discharge from secondary infections. There are conditions, moreover, caused by a severe paroxysm of coughing, or by a prolongation of these paroxysms, in other words, hemorrhages; perhaps more or less

4. Kolmer, J. A.: The Diagnostic Value of a Blood Examination in Pertussis, Am. Jour. Dis. Child., June, 1911, p. 431.

emphysema; always cardiac strain, and perhaps cardiac dilatation; and, if frequent or repeated coughing, anemia and emaciation. Hemorrhages may occur from the nose, in the eyes, or even in the brain.

The cough is laryngeal in type, is at first dry, and later becomes spasmodic and paroxysmal, thus differing from that of ordinary colds; that is, the coughs occur in series, more or less periodically, or in showers. With these paroxysms there is more or less closing of the larynx, with the attempt at inspiration through a narrowed glottis, which causes the characteristic whoop. These paroxysms increase in frequency as the disease progresses, and are precipitated by any change in the atmosphere and by suddenly breathing in cold air, as by laughing, and even by swallowing food, and they sometimes occur without any apparent cause, because of irritation from the germ and its consequences. The number of paroxysms in twenty-four hours varies, but there may be as many as fifty. Early in the disease there may be a slight fever.

TREATMENT

Unless the patient has considerable rise of temperature, it may not be necessary to put him to bed, but, especially with children, the paroxysms are generally diminished if the child is kept in bed for a time, or at least kept quiet. The more active the child, the more paroxysms. Consequently, even without fever, if a child vomits almost every meal, or if he coughs so severely as to cause hemorrhages, or shows that the right side of the heart is becoming strained (which is the side of the heart most affected), he must be put to bed and remain there.

In most communities a schoolchild with whooping-cough is immediately sent home. In only a certain proportion of communities as yet is whooping-cough a reportable disease. There is no question that it should be reported; that the child affected should be isolated

as much as possible; that the infection of others should be prevented, if possible, and that other children in the same family and perhaps in the same household or tenement, who are attending school, should be sent home until the period of incubation is past, dating from the last contact with the infected patient.

The methods of contact have already been suggested, and it is needless to emphasize the necessity for the school authorities to cleanse and clean the desk, chair and immediate surroundings of the child, and the books, pencils, etc., that he used. Also the children who sat in close relationship to this infected child should be watched by the medical inspector, or, perhaps, scientifically examined, as suggested above (that is, throat secretions and blood) and those who show any signs of infection should be sent home until it is shown that they have not become infected. These preventive measures seem almost too severe or too great for a disease that has been considered so simple, but, as previously stated, the disease and its results in preventive medicine will be in diminishing this disare not simple, and the number of deaths among young children is very great. One of the greatest advances ease that has been so long neglected.

Instruction should be given by the physician to the mother, or whoever cares for the child with whooping-cough, as to how the prevention of infection of others should be carried out, such as the care of handkerchiefs, napkins, etc. In communities where the disease is reportable, the board of health should send instructions to the family.

The actual treatment of this disease may be divided into four heads: (1) to prevent the infection of others; (2) to shorten the disease, if possible; (3) to diminish the severity of the paroxysms; (4) to treat complications as they occur.

The first indication has already been considered.

The second indication is met by general hygiene and by drugs. Fresh air and sunshine, without exposure, are among the greatest mitigators of this disease. If the weather is pleasant, the child should be out doors or on a veranda most of the time. A child does much better in the country or at the seashore, if the season and circumstances will allow it. If the child is too sick, or the weather is such that it is impossible to remain outdoors, he should be isolated in one, or better, in two large rooms, so that while one room is being thoroughly aired and cleansed he may go to the other one. There seems to be no question that the more infected or polluted the atmosphere of a room, the more the child will cough. Whether such an atmosphere simply irritates, or he reinfects himself instead of having his infection diminished, is unimportant. The fact remains that the ventilation must be excellent to diminish the frequency of the paroxysms.

Another important factor is nutrition. If the child vomits a meal as soon as he has eaten it, during a paroxysm, in a few minutes he should be given food again, with the probability that the next paroxysm will not so quickly occur but that the food may remain in the stomach and be digested. A child that receives insufficient nourishment from any reason should be given food more frequently. The character of the food should depend on his condition, and should be that which is found to be less frequently vomited. The best diet is cereal and vegetable, with milk and eggs. The end-products of meat metabolism are likely to raise the excitability and irritability of any one whose nervous system is irritated. For this reason meat should not be given, and no tea or coffee. A patient who is not allowed meat should receive a small dose of iron once or twice a day. Calcium in any simple form may be used as a nervous sedative and a nutrient. Hot baths before going to bed relax the nervous system and quiet the patient. Also massage is sometimes soothing.

Of course, it is always essential to have the bowels move daily. Plenty of water should be given the child, as the more moist the mucous membranes, the less they are irritated, and the less frequent the paroxysms. For this object many inhalants have been advised. Perhaps the most important element of these inhalants, whether sprays or steam, is the water that they contain. Sometimes bland petroleum oils atomized and inhaled soothe the irritated mucous membranes.

Various antiseptics have been suggested. The most frequently used is perhaps phenol (carbolic acid) in some form, and very popular has been the vaporization of a phenol combination in the atmosphere of the room. There is no question that phenol tends to benumb peripheral nerves. If much phenol was absorbed it would disturb the kidneys. Exactly what are the germicidal constituents or powers of such inhalants has not been determined. Phenol sprays have been used in from 0.5 to 1 per cent. strength. Antipyrin as a spray and gargle has been much used as a germicide in from 5 to 10 per cent. strength, and has been much lauded in this disease. Quinin sprays, though more disagreeable, have been used in the throat as germicides. Various combinations with thymol and eucalyptol, and other mild aromatic antiseptics, have been used as sprays and gargles or inhalants. It is quite probable that a creosote or other antiseptic inhalant may inhibit the growth of germs in the trachea and upper large bronchi, provided the patient is old enough to cooperate and inhale the vapor into the lungs to that depth. As an application in the pharynx and mouth, hydrogen peroxid solutions, 1 : 5, would be as efficient as anything that could be offered. Many times, however, these "antiseptic" inhalants or atomizing substances cause irritation and paroxysms, and must be abolished, while mild alkaline solutions, well represented by ¼ teaspoonful of sodium chlorid and ¼ teaspoonful of sodium bicarbonate in a glass of

warm water, cleanse and soothe the throat without causing paroxysms.

There are still many who believe that quinin given internally will shorten the disease. It has not yet been shown that quinin inhibits the growth of the Bordet-Gengou bacillus. If there is any tendency to secondary infection in the nasopharynx, with congestion of the ears, of course quinin should not be given.

Also, to meet this indication and shorten the disease is the vaccine treatment. The exact value of vaccine in this disease has not been demonstrated.

Sill[5] made a study of this treatment in whooping-cough, and found that the dose of the bacillus should be 50 million, and this dose given every other day in ordinary cases, and every day, or 100 million every other day, in severe cases. The injections were given into the abdomen or buttocks. He thinks that the average dose should be determined by the severity of the disease, and not by the age of the child, and he vaccinated a child even as young as 1 month old. He feels sure that the length of the paroxysmal stage of the disease is diminished, and that the paroxysms are diminished in severity.

Immunizing doses, to prevent the development of the disease in other children of the family, have been given in doses of 20 million bacilli, and the dose repeated four or more times, and the disease has been apparently prevented by such vaccination. More recently Hess[6] has made a careful study of the vaccine treatment of whooping-cough, and was disappointed in this treatment of the disease; but he did find that in a certain percentage of cases immunizing doses prevented the development of the disease, although this prophylaxis was far less efficient than is typhoid vac-

5. Sill, E. M.: The Vaccine Treatment of Whooping-Cough, Am. Jour. Dis. Child., May, 1913, p. 379.

6. Hess, A. F.: The Use of a Series of Vaccines in the Prophylaxis and Treatment of an Epidemic of Pertussis, THE JOURNAL A. M. A., Sept. 19, 1914, p. 1007.

cine in preventing typhoid fever. Positive conclusions, therefore, as to the value of vaccine treatment in whooping-cough cannot yet be made.

The third indication, namely, to diminish the severity of the paroxysms, is of great importance. It has already been stated that the more quiet the child, the less frequent will be the paroxysms. Also, if the child lies down as soon as he begins to cough, he is less likely to vomit. An elastic abdominal belt seems to be of value in controlling the vomiting and the paroxysms of young infants especially. In some patients the paroxysms are so severe that chloroform inhalations have been given to prevent the intensity of the spasms. Also, it has been stated that inhalations of chloroform actually lengthen the time between the paroxysms and shorten the disease. Chloroform inhalations may act as a germicde. On the other hand, the frequent administration of chloroform, even in small doses, is known to injure both heart and kidneys.

The most effective of all medicinal treatments, in the opinion of several authorities, is antipyrin and digitalis. A very good rule for the dosage of antipyrin is 0.05 gm. (about 1 grain) for every year of the child's age. This should be given three or four times a day, depending on the frequency of the paroxysms. The frequency should be diminished as the frequency of the paroxysms diminishes. Coincident with the antipyrin should be given digitalis in the form of the tincture, and in the dose proper for the child's age, and determined by its effect on the child's heart and pulse. The heart needs help, both from the strain of the disease and also as antipyrin might cause some weakening of the heart. The antipyrin acts by causing less irritability of the nervous system and relaxing muscle spasm. Even although the drug has disadvantages, its disadvantages are much less than the harm caused by the whooping-cough paroxysms.

The bromids have been frequently given and in large doses. They act by inhibiting the reflex activity of the nervous system and by more or less dulling the peripheral nerves in the throat and upper air passages. Chloral has been used in order to depress the nervous irritability. Atropin or belladonna have been given in large doses, and their value must be in dulling the peripheral nerves in the irritated part of the body. Atropin is a stimulant, and cannot have any good effect in this disease, unless the dose is very large, and with such large doses atropin intoxication readily occurs, that is, the pulse becomes rapid, the throat dry, the face flushed, and there is likely to be cerebral excitation and perhaps dilated pupils.

Antipyrin is best given to a child in solution, as follows:

	Gm. or c.c.	
℞ Antipyrinae	5	ʒ iss
Aquae menthae piperitae...	100	fl℥ iv

M. et Sig: A teaspoonful, in water, three or four times a day.

This dosage is for a child 5 years old.

Various hydrotherapeutic measures are often of value, and the hot bath is always useful in quieting the patient and relieving internal congestions.

The fourth indication, namely, to treat complications as they occur, is almost supererogation, as each complication calls for its proper treatment. However, under this heading the prevention of such complications may be urged. Vomiting may be prevented by quiet, rest for a while after eating, by the abdominal belt and by proper food. Nutrition must be kept up at any cost, and, if necessary, the child given simple liquid nourishment every three hours. Not infrequently cod-liver oil is well borne and is an oil nutriment of great value. Anemia must be prevented by iron. If it is seen that the heart is becoming strained, and the face and throat remain congested even after the paroxysm is over, showing that the right ventricle

is in trouble, digitalis should be given and such rest as would be given any damaged heart. This treatment also tends to prevent hemorrhages. Even if the child is weak and the circulation is weak, strychnin is inadvisable, as it stimulates the nervous system and causes or allows more paroxysms to occur.

If the child has a history of enlarged glands or recurrent colds, or has inherited a tendency to tuberculosis, or tuberculosis has been present in the child's family, its convalescence after whooping-cough should be prolonged, and country or seashore air should be urged where possible. Certainly, such a child should not be confined in school until his nutrition has become as good as before the infection with whooping-cough occurred.

MUMPS

This is a highly infectious disease, with a long period of incubation, from two to three weeks. There is more or less of it always present in most cities, and there are likely to be epidemics of it in certain seasons of the year, more particularly, perhaps, in the spring and fall. Children and youth, especially boys and young men, are the most susceptible to it. Infants and adults are not so likely to have it. Possibly adults are less likely to have it because they have been rendered immune by unrecognized mild attacks in childhood.

While the typical localization of this infection is in one or both parotid glands, the submaxillary glands may be coincidently involved, or may be the only glands involved. As simple and harmless as this disease generally is, it may cause very high temperature, sudden cardiac failure, and frequently in young boys and male adults a complication, or metastasis, of orchitis, which is always serious. In girls the mammary glands or the ovaries may show metastatic inflammation.

The complication of inflammation of the sexual glands is frequently attributed to the patient's taking cold. While chilling may be a factor in causing such complications, young men especially who remain in the house or even in bed may develop this complication of orchitis, and the danger of such a complication is greater after puberty than before. The peculiar interrelation of the parotid gland and the testicles or ovaries is biologically interesting, but has not been explained. Other complications are diarrheal attacks with bowel cramps, and in rare instances serious meningitis occurs. It is rare that more than one testicle is affected. This is exceedingly fortunate, as this

testicle may be long hypertrophied and later atrophy and become permanently sexually insufficient. It is probable that the same history is true of an ovarian complication, and may be an undiagnosed cause of some forms of ovarian pain and dysmenorrhea.

The parotid glands in this affection seem to show no tendency to suppurate, but parotitis, whether the epidemic form or a complication of some other disease, may cause serious cardiac depression. Even with high temperature in epidemic parotitis the pulse will often be found abnormally slow, at least for the height of the temperature.

Any great amount of manipulation of the inflamed parotid gland in mumps should be condemned as tending to cause absorption into the circulation of depressant toxins or secretions. This caution is not unique, but is parallel with the danger from too much manipulation of a hypersecreting thyroid gland, causing absorption into the blood of cardiac depressants.

The prognosis when meningitis is present is serious. Deafness has been caused, and even an optic neuritis has been stated to occur. Sudden death occasionally occurs without any assignable cause, except a sudden upright position after a patient has been in bed. Albuminuria may be present with high temperature, and acute nephritis has occurred. Endocarditis is another rare complication.

The white blood count in this disease is more or less characteristic, there being a lymphocytosis, although the whole number of leukocytes may vary, early in the disease being below normal. Barach[1] states that there is a leukopenia due to a decrease in the polynuclear cells, both relatively and absolutely, all through the disease. On the other hand, Feiling[2] states that there is always a slight increase in the total number of leukocytes. Barach also states that the mononuclear

1. Barach, J. H.: Morphology of the Blood in Epidemic Parotitis, Arch. Int. Med., December, 1913, p. 751.
2. Feiling, A.: Lancet, London, July 12, 1913.

cells are relatively and absolutely increased. As the blood returns to normal the eosinophils, which have been almost absent, return in their usual numbers. This blood count is very distinct from the leukocytosis that is apt to be present if the gland is infected secondarily and an abscess is liable to form, in which case there would be a polymorphleukocytosis.

Contagium from this disease is probably pretty direct, that is, by close contact; but the contagium may be transmitted from the very early stages of the disease to perhaps some time after the disease is in abeyance. It has not been shown that animals are affected by the disease.

A patient with the disease should generally be isolated, and the attack will often be milder if the patient remains in bed. Although the disease can be serious, it is generally so mild in children that it is sometimes a question whether other children of the same family should not be allowed to contract it, for the reason that one attack generally confers immunity for all time, and the disease is much more serious in adults, especially in young men, than in children. Of course, an infected child, even though very mildly sick, is immediately sent home from school. On the other hand, doubtless not a few children with very mild cases are unwittingly allowed to remain at school.

The disease generally begins in one parotid gland and quickly goes to the other, although not infrequently only one gland is affected. Occasionally the submaxillary or sublingual glands are the only ones attacked, and these cases may spread the mumps before the diagnosis is made. The inflammation in the first gland affected generally reaches its height in about four days, and the gland generally has returned to its normal size in from six to eight days. If the other gland is not quickly inflamed, but becomes inflamed later, the duration of the disease will be prolonged. The fever is generally mild, but it may be

very high, and in such instances there is always likely to be more or less cardiac depression.

The same care of the child's surroundings in school should be given as in other contagious diseases to prevent the infection of others. The nurse or the mother should understand that infection is doubtless contained in the mucus and secretions of the mouth and throat; consequently infection will be given by close contact, as by kissing, by handkerchiefs, eating utensils, pencils, bedclothing, etc.

TREATMENT

The disease is so mild that it may not require any special treatment. Pain in the infected glands is rarely severe, and is modified by dry warmth or simple absorbent-cotton applications, and by any oily application, the latter to relax the tension of the skin over the swollen gland. For this purpose olive oil may be used, or petrolatum, or an ointment may be made with 10 per cent. methyl salicylate in petrolatum. It is inadvisable to use ice or cold applications to the parotid glands in mumps.

The diet should be mild, the bowels kept free, and in simple cases medicinal treatment is not needed. If the fever is very high, one or two doses of antipyrin or acetanilid may be given, with the knowledge that cardiac depression readily occurs in this disease. Hot drinks, as hot lemonade or hot tea, with a little alcohol in some form for its physiologic action in dilating the peripheral blood-vessels and promoting perspiration, is a satisfactory method of reducing the temperature. Tepid sponging may be of benefit, and hot sponging should be given the patient daily if he is too ill for a hot bath.

If a testicle is affected, the lesion is generally an orchitis, or it may be an epididymitis. Ice and cold applications are inadvisable in this metastasis from mumps. Warm, moist applications often relieve

pain; but if the testicles are kept elevated and surrounded by absorbent cotton, and if perhaps some oil or fat, such as petrolatum, is applied, the inflammation will probably go away as rapidly as by any other treatment. Strapping is inadvisable in this complication. Any massage, or the rubbing in of any ointment or other preparation in this kind of orchitis, or to the parotid glands, is inadvisable in mumps. Ichthyol applications in from 10 to 20 per cent. strength, either in petrolatum or in olive oil, or glycerin and water, have been largely used locally in this inflammation. Lead and opium wash has been frequently used; but the less this inflamed gland is manipulated, the better.

If the mammary gland becomes metastatically inflamed, the treatment is about the same as that for the parotid. If it is decided that the ovary is inflamed, but little can be done, except absolute rest and the administration of a sedative if there is pain. If there is much pain from any of these inflamed glands, morphin or codein may be advisable if it seems unwise to give a coal-tar analgesic.

DIPHTHERIA

This disease was long thought to be due to filth, because, like all sore throats, etc., it seemed to be more prevalent in dirty, damp, and crowded places. This is true only because it is not so readily eradicated from such surroundings, more cases are not discovered, and more carriers are found in such localities. Many sore throats were termed diphtheritic when they were septic, or cases of tonsillitis with membrane, or were really scarlatinal cases. Also, membranous croup was long held to be distinct from diphtheria. With the discovery of the contagium of diphtheria, the Klebs-Loeffler bacillus, it is now conceded not only that the discovery of this germ in the secretions of the throat, nose, or other parts of the body proves that diphtheria is present, but also that its absence is proof that the disease is not present, provided that the swab is properly taken and the culture made by an expert. Also, it has now long been proved that membranous croup is laryngeal diphtheria.

This throat inflammation, now termed diphtheria, has been known for centuries, having first appeared in the East and later in Europe, occurring mostly in epidemics. Now it is endemic in most civilized cities, although small epidemics, localized in certain buildings, public institutions, tenements, or schoolhouses, frequently occur. A carrier of this disease may communicate it to persons so widely separated as to make the occurrence of the disease almost unexplainable by any epidemic theory. While nearly all mankind is susceptible to small-pox, and a large majority to scarlet fever, many persons seem naturally immune to diphtheria. Also, a closer contact is apparently needed with an infected individual than in these other diseases.

As one attack of diphtheria does not cause immunity from the disease for any great length of time, and as preventive measures do not protect for any great length of time, it is difficult to eradicate this disease. Small-pox could doubtless be prevented entirely in any country in which every individual was vaccinated at least two or three times during his life. Such prevention of diphtheria cannot be expected; but a more rigid quarantine of diphtheria patients, and a greater effort made to discover carriers and isolate and treat them will render diphtheria less and less frequent.

This disease has always had a large percentage of deaths; but the death rate since the introduction of antitoxin has been constantly on the decrease, and with a better understanding of the proper dosage of antitoxin, and with the effort made to diagnose the disease early, the death rate will be more rapidly decreased. Our best sanitarians believe that for every case of diphtheria recognized, at least one sore throat that carries the Klebs-Loeffler bacillus escapes; in other words there is an equal number of missed mild cases.

It has been shown that patients with diphtheria when coughing, or even talking, will throw diphtheria bacilli into the air, and if such are deposited on culture plates not far from the patient, diphtheria bacilli will grow. It has also been shown that the Klebs-Loeffler bacillus lives longer where it is cold and damp than where it is dry and hot. The disease is more prevalent in cold weather, and the germ does not die so readily and become non-infectious in cold, damp rooms. Besides every care to prevent the spread of infection from the patient, the bedroom should be kept warmer in cold weather than with most diseases, not only because of the foregoing fact, but also because the toxins of diphtheria bacilli are depressing, and the patient's temperature is often too low.

It has been shown that the normal hydrochloric acid in the stomach inhibits or kills the diphtheria bacilli; therefore it is exceedingly rare to find these

germs in the intestines, and very rare to find diphtheritic membrane in the stomach.

In the majority of cases the tonsils, one or both, are the parts affected in diphtheria, and with the present methods of treatment, in a large portion of these cases the membrane will be limited to these regions. The soft palate is next most frequently attacked, the pharynx next, and nasal diphtheria, with proper care taken, is not very frequent. Laryngeal diphtheria is not a frequent complication to tonsillar diphtheria; it generally begins as the original point of attack.

CARRIERS

These may be convalescents from diphtheria, or may be those who have had contact with diphtheritic patients who may or may not later develop the disease, or the term may be perhaps more properly limited to those who carry the germ for months. Diphtheria germs may live a long time on books or other substances, handled, coughed, sneezed or expectorated on by a diphtheria patient, and may infect persons coming in close contact with such infected material. This method of infection may not be very frequent. Animals may carry the infection. It is doubtless a good axiom to believe that a tonsillitis with exudate is diphtheria until it is proved not to contain the Klebs-Loeffler bacillus. Such a patient should be more or less rigidly isolated, as streptococcic infection is, if anything, more readily communicated than is a diphtheria infection. Therefore, there can be no excuse for not isolating a sore throat with exudate or membrane as soon as such a case is discovered.

The subject of carriers and the length of time which the Klebs-Loeffler bacillus may remain in the throat may be studied by reference to the article of Henry Albert[1] and that of Henry Page.[2] Both of these

1. Albert, Henry: The Treatment of Diphtheria Carriers, The Journal A. M. A., Sept. 27, 1913, p. 1027.
2. Page, Henry: Diphtheria Bacillus Carriers, Arch. Int. Med., January, 1911, p. 16.

papers give many references and quote many authorities. Albert quotes Ledingham as stating that 50 per cent. of persons affected with diphtheria have lost the bacilli by the time the local membrane has disappeared. The average length of time that the bacilli will persist in a throat is thirty days, as shown by a very careful clinical and bacteriologic study of a diphtheria epidemic by Jessie W. Fisher.[3] She found that these germs could persist for more than 100 days, and in one instance 111 days. Not every bacillus carrier shows virulent germs, but in a large proportion of such bacilli carriers the germs are virulent; therefore a bacillus carrier should always be considered able to infect others. Even if such bacilli are proved not to be fatal to guinea-pigs, they might be able to infect a human being. Dr. Fisher also discovered that a sewer could become contaminated with diphtheria bacilli, that rats living or eating refuse in this sewer could become infected, and that cats catching or eating the rats could become carriers. Cats associating with a diphtheritic patient may frequently become carriers.

Klein[4] thought that cows could become infected and could cause infection of milk, which, unboiled, could infect an individual. Infected milk certainly can cause streptococcic throats, and it would seem likely could cause diphtheria. Probably a pet dog could carry the disease as readily as a cat. Therefore the rule and regulation of every physician should be that cats and dogs should be excluded from the sickroom of a patient with any kind of sore throat; and if other cases occur in a family in which quarantine is properly carried out, not only should the throats of all persons be examined, but also the cat or dog should be suspected.

The location of the Klebs-Loeffler bacillus in carriers who are convalescing is probably most frequently

3. Fisher, Jessie W.: A Diphtheria Epidemic, The Journal A. M. A., Feb. 6, 1909, p. 439.

4. Klein: Local Gov. Board Rep., London. 1899, xxix.

in the throat, though the bacillus may be found in the nose. In those who carry these germs long they are more likely to be found in the nose. Therefore, swabs should be taken of both regions. It is quite probable that a surface swab from a tonsil may be negative while a culture obtained from probing into crypts of the tonsils or in the region back of the tonsil might show the presence of the germ. It is culpable neglect to fail to examine a patient thoroughly to ascertain if he is free from the Klebs-Loeffler bacillus.

The boards of health vary as to the number of negative cultures that will release a patient from quarantine. The safest number is perhaps four negative cultures, two from the throat and tonsils, one from crypts or back of the tonsil, and one from the nose, taken on alternate days, at a considerable interval from the use of any antiseptic washes, gargles or sprays. This would seem to prove that a patient was free from the Klebs-Loeffler bacillus. In instances in which epidemics of diphtheria have occurred and cultures have been taken from the throats of a large number of well persons in the same institution, it has almost invariably been shown that a certain small percentage of such persons have acquired the germ and are carrying it without becoming actively infected.

TREATMENT OF CARRIERS

Various methods of ridding a carrier of the diphtheria germ have been tried. Local measures vary, and may comprise painting the suspected regions with tincture of iodin or with Lugol's solution, with silver solutions, phenol solutions, or the use of various gargles, hydrogen peroxid solutions, etc., and the nasal inhalation of various thymol or iodin inhalants or sprays. There is no question that whatever else is done, some local antiseptic should be applied. Diphtheria antitoxin injection has not been very successful. Local applications in the mouth, throat or nose of antidiphtheritic serum have not been proved to be

very successful. Vaccinations with dead diphtheria bacilli have been only partially successful. These various methods are described by Albert.[1] He believes that a local application to suspicious crypts of the tonsils of a "5 per cent. solution of silver nitrate will destroy all bacteria with which it comes in contact." A thorough application of a 10 per cent. solution of silver nitrate he finds will cause some destruction of the epithelium of a crypt and a fibroblastic proliferation with ultimate obliteration of the lumen, which is of course the object desired.

The most successful treatment of diphtheria carriers seems to be that of spraying the nose and throat with pure cultures of *Staphylococcus pyogenes aureus.* According to the reports, this spray is apparently harmless to the individual. This method was first used by Schiøtz, in 1909. Although it is not always efficient, in some instances it has removed the Klebs-Loeffler bacillus and prevented its growth so that cultures were negative to it in a week or less. It has not proved very successful in nasal cases. Discussions of this treatment are given by Catlin, Scott and Day,[5] Lorenz and Ravenel,[6] and Rolleston.[7] On the other hand, Womer,[8] after using this staphylococcus spray in forty-two cases of diphtheria carriers, comes to the conclusion that although it is harmless, it does not appreciably lessen the period of quarantine. This leaves the value of this treatment still subject to positive proof. It may certainly be tried.

Womer states that "apparently most of the carriers do not spread the disease after sixty days from the day the disease begins." The word "most" leaves this

5. Catlin, S. R.; Scott, L. O., and Day, D. W.: Successful Use of the Staphylococcus Spray on Diphtheria Carriers, THE JOURNAL A. M. A., Oct. 28, 1911, p. 1452.

6. Lorenz, W. F., and Ravenel, M. P.: The Treatment of Diphtheria Carriers by Overriding with Staphylococcus Aureus, THE JOURNAL A. M. A., Aug. 31, 1912, p. 690.

7. Rolleston: Brit. Jour. Child. Dis., July, 1913.

8. Womer, W. A.: Results of Staphylococcus Spray Treatment in Forty-Two Cases of Diphtheria Carriers, THE JOURNAL A. M. A., Dec. 27, 1913, p. 2293.

assertion doubtful as far as general practice is concerned. Any one person who carries the disease may be one that could infect others.

Wood[9] thinks that in one or two instances, in diphtheria, spraying the affected areas with live lactic acid bacilli hastened the disappearance of the diphtheritic germ. Antiseptics should not immediately be used in the throat after such spraying, as he thinks it is the live bacilli that act perniciously on the diphtheria bacillus. This suggestion is worthy of further investigation.

Miller[10] recommends that diphtheria carriers have their throats sprayed with warm formaldehyd solutions every three or four hours during the daytime. The strength which he recommends to begin with is 0.25 or 0.5 per cent. in water of a 40 per cent. formaldehyd solution. [The official Liquor Formaldehydi is a 37 per cent. solution.] This solution may be increased in strength to 1 per cent. if deemed advisable. He found that in from three to six days the diphtheria bacilli disappear from the throats of carriers thus treated. He urges that the solution be prepared fresh each day. He did not find that the kidneys were irritated by such treatment.

IMMUNITY

While it has been long known that infants and many adults seem not to be susceptible to diphtheria, it has only lately been shown that probably a large proportion of adults, stated at 90 per cent., perhaps 50 per cent. of children, and perhaps 80 per cent. of newborn infants have diphtheria antitoxin in their blood and are not likely to become ill with diphtheria. It should be noted, however, that individuals protected against self-infection may be carriers of diphtheria bacilli which can infect others. How many of these immune adults or older children have been always immune, and how many have acquired immunity by

9. Wood, Harold B.: Lactic-Acid Bacillus Spray for Diphtheria, THE JOURNAL A. M. A., Aug. 9, 1913, p. 392.
10. Miller: Med. Rec., New York, July 25, 1914.

contact with diphtheria germs, is not known. Nurses and physicians who frequently care for diphtheria patients have been shown to have antitoxin in their blood, though they may never have had the disease.

A skin test has been devised, known as the Schick reaction, to determine whether or not an individual is protected against diphtheria, that is, whether he has diphtheria antitoxin in his blood. The reaction seems very positive, and distinctly shows whether an individual is artificially protected or has natural antitoxin against this disease. The test is made with a dilute diphtheria toxin of such strength that 0.1 c.c. contains one-fiftieth of the minimum fatal dose for a guinea-pig. This amount, namely, 0.1 c.c., is injected into the layers of the skin, perhaps best on the inner surface of the arm. A positive reaction should appear in from twenty-four to forty-eight hours, and is evidenced by a slight swelling and localized redness, a reddened papule which remains from seven to ten days. When this papule disappears, the skin over it may desquamate slightly, and pigmentation may remain for days and even weeks. Park states that the injection is best given with a small hypodermic syringe with a platinum point needle, that the injection must be into the skin and not subcutaneously, and that immediately after the injection there should be a raised whitish spot, which in twenty-four hours becomes bluish, with a slight edema. Schick's interpretation of the positive reaction, as just described, is that the patient has no antitoxin in his blood, or at least less than 1/30 unit of antitoxin in 1 c.c. of blood. He declares that all persons so reacting are susceptible to diphtheria, and Park agrees with him. Park,[11] in his summary on immunity in diphtheria, states that according to Hahn the interval between the injection of vaccine and the development of antitoxin is not less than three weeks, while other

11. Park, W. H.; Zingher, A., and Serota, M. H.: Active Immunization in Diphtheria and Treatment by Toxin-Antitoxin, THE JOURNAL A. M. A., Sept. 5, 1914, p. 859.

investigators think that it may be eight days. Persons who have a natural antitoxin show an earlier increased antitoxin production. Von Behring considers that 0.01 unit of antitoxin per 1 c.c. of blood is sufficient to protect a healthy individual, and much less may protect against diphtheria.

Park states that last year in the Willard Parker Hospital one-fourth of the inmates were diphtheria carriers, and he found that "active immunization produced a very decided increase of antitoxin in a relatively short time in all persons who had natural antitoxin." Park found that 400 out of 700 scarlet fever patients showed natural immunity by the Schick reaction; that is, 57 per cent. were immune. He comes to the conclusion that persons positively exposed to diphtheria should be passively immunized even if the toxin-antitoxin injections have been given; but he urges that the Schick test will prevent the necessity of immunizing about two-thirds of such exposed persons. In other words, a person suspected of being exposed to diphtheria should receive the Schick test. If this is positive, showing that he is susceptible, he may be passively immunized with antitoxin. If he has not been immediately, but is likely to be, exposed and should be protected, he may be actively immunized with a vaccine. Such active immunization Park believes will last only from one to two years; hence general protection of large numbers of individuals against this disease cannot yet be urged. Park quotes Bauer as finding that the persistence of the bacilli in carriers is not shortened by active immunization.

The toxin-antitoxin injections used by Park are described in his article. The von Behring vaccine[12] "consists of a mixture of strong diphtheria toxin and antitoxin in such proportions that the toxin is just neutralized or is in very slight excess when tested on

12. Veeder, B. S.: Active Immunization Against Diphtheria by Means of von Behring's Vaccine, and the Diphtheria Toxin Skin Reactions, Am. Jour. Dis. Child., August, 1914, p. 154.

a guinea-pig." These injections are given intracutaneously, and immunity occurs in about ten days. Individuals with natural antitoxin in the blood may be more susceptible to reaction from this toxin-antitoxin vaccine than those without such antitoxin, and individuals who have antitoxin in their blood from previous infection may show a hypersensitiveness to the injection.

As just stated, patients so actively immunized are apparently protected for at least one year, while a patient who receives an immunizing dose of antitoxin is protected for perhaps not more than ten days. However, this antitoxin immunization is rapid and will generally protect a patient from one exposure to this germ.

Veeder[12] carefully reviews the literature on the subject of this vaccination, and finds that there is a marked variability of reaction to such injections, and quotes Kissling as believing that the injection should be made into the back instead of the arm, and that more dilute injections should be given, and if a milder one causes considerable reaction, a stronger one should not be used. If the milder one causes no reaction, a strong injection may be given. A "negative phase" has not been discovered; a patient who has been vaccinated with toxin-antitoxin, on subsequent exposure to diphtheria may receive antitoxin without showing hypersensitiveness. It has been shown that diphtheria carriers have more antitoxin in their blood than is found in the blood of patients who have just recovered from an attack of the disease.[13]

Von Behring[14] believed that the dose of toxin-antitoxin injected can be gaged accurately according to the weight of the individual. This he has worked out on animals.

The future advantage of this kind of protection against diphtheria lies in the fact that a foreign serum like horse serum need not be used in a patient who is

13. Otto: Deutsch. med. Wchnschr., March 12, 1914, p. 542.
14. Zangemeister and von Behring, Deutsch. med. Wchnschr., May 22, 1913.

a hay fever or asthma subject. It is quite probable that it would be unwise, at least at the present time, to use this toxin-antitoxin in diseased or damaged individuals, as those with a weak or diseased heart. At least, this precaution is suggested. It may later be shown that a dose so small as to give practically no reaction may still be sufficient to immunize. It is reported by Schreiber[15] that in vaccination by von Behring's method of 700 schoolchildren and 300 children in a hospital, there have been no untoward effects.

Immunizing doses of antitoxin to persons who have been exposed to diphtheria, given early, are generally successful in preventing the development of the disease. The immunizing dose for a child should probably be at least 1,000 units. Doubtless adults should receive larger doses. In the epidemic reported by Dr. Fisher, of the large number of immunizing doses given, but one person, a nurse, subsequently developed an attack of diphtheria during the period of observation. She had a mild attack at the end of two weeks. Dr. Fisher believes that two weeks is the limit of protection from a dose of immunizing antitoxin.

In the epidemic which occurred at Johns Hopkins Hospital, in 1911, Dr. Ford[16] reports that of 300 prophylactic doses of antitoxin administered, in most cases the reaction was limited to a slight urticaria. In a few instances there was some local edema, tenderness, and elevation of temperature. In five cases there were characteristic symptoms of serum disease, and in one of these cases there was typical anaphylactic shock. The patient who developed shock had previously received antitoxin, and had a history of asthma. It would have been interesting to note if all the other individuals who received the antitoxin had never been subject to asthma or hay fever: whether this shocked individual was the only one who had a history of asthma.

15. Schreiber: Therap. d. Gegenw., 1914, lv, No. 3.
16. Johns Hopkins Hosp. Bull., October, 1911, p. 357.

PROPHYLAXIS IN SCHOOLS

When it is reported to a school board and to a board of health that a schoolchild is sick with diphtheria, it should first be remembered that with every discovered case probably one other missed case occurs. Of course the sick child is isolated. The other children of this family should have cultures taken from their throats to determine whether or not the Klebs-Loeffler bacillus is present; but without waiting for the results of this investigation, each should receive an immunizing dose of 1,000 units of diphtheria antitoxin, unless their history shows that they are asthmatics or sufferers from hay fever. As it takes from twenty-four to forty-eight hours for the Schick test to develop, it seems unwise, in the case of children who have been in close contact with the infected patient, to postpone the administration of the antitoxin, until a Schick test shows whether or not they are already protected.

These children should, of course, all be forbidden to attend school, and should be isolated as far as possible from other children. If the infected child comes from a tenement house where there are many children, the other children in this tenement should also be excluded from school until it is shown that their throats contain no Klebs-Loeffler bacilli.

If several cases of diphtheria occur one after the other or more or less rapidly in a schoolroom, or in different parts of a school, all of the children who are closely associated, either at their desks, or in classes, or as chums, should have their throats tested to ascertain who are the bacillus carriers. Instruction should be carefully given to the parents of the children who are well but have been positively exposed to diphtheria, to prevent their playing with unexposed children, thus possibly spreading the disease before it is ascertained that they are free from diphtheria bacilli.

General disinfection, by fumigation, of a schoolroom which has contained several diphtheria cases is

considered by most advanced sanitary experts as unnecessary and of little value. If swabs from the throats of all the children in this room are taken and the room then closed for twenty-four hours and thoroughly sprayed and washed with germicidal solutions, the other children who do not belong to the infected families may return to the schoolroom as soon as the board of health has determined which throats carry the diphtheria bacilli. It does not seem scientifically wise or economically sensible to close a schoolroom or a school building for an indefinite period when the foregoing measures will be effective in stamping out the disease.

A child whose throat and nose is found to be free from the Klebs-Loeffler bacillus may immediately return to school, provided he is not allowed to come in contact again with a new case of diphtheria. A child whose throat does contain the diphtheria bacilli, though he is not ill, should be isolated and treated with antitoxin if he has been recently exposed, or with the method suggested above for treating carriers, if he has apparently not been recently exposed. Under any circumstances, such a child should not be allowed in school.

The throats of the teachers and instructors in the schools in which diphtheria has occurred should also be tested. Other members of the family in which there is a patient with diphtheria should be examined and if they are found free from the bacilli and do not come in contact with the patient, they can with propriety live at home and attend to their regular occupation. This is on the supposition that the infected patient is properly quarantined (which means the kind of quarantine advised by the board of health), is attended by a physician, and is cared for by a nurse, or by one person who remains isolated with the patient, at least as far as close contact with others is concerned. There is no reason why the nurse should

not change her clothing and go out for fresh air daily. She should not go into stores or ride in cars where she might give the disease to others, as she is likely to carry the germ in her own throat, though being herself immune.

TREATMENT

A. Isolation.—It should again be urged that a throat with spots or membrane should be considered as likely to be diphtheritic until a culture has proved it not to be. Such a patient should be isolated in the best room available, looking toward the possibility of the disease being diphtheria and a nurse being required. Other children of the family must be excluded from contact with this patient. If the case is clinically one of follicular tonsillitis, the physician may wait for a positive test before giving antitoxin. If, however, the case is clinically diphtheria, antitoxin should be given without a report being waited for, provided there is nothing in the history of the patient to show that there will be any hypersusceptibility to horse serum. If the disease is diphtheria, and the patient is in a tenement where it is impossible to carry out isolation, he should be removed to a contagious disease hospital, if the city has one. Whether it is follicular tonsillitis, or other streptococcic infection, or diphtheria proper, gargles and local cleanliness of the throat should be immediately inaugurated, and when this is properly carried out, the danger of infection of others is reduced to a minimum.

It is hardly necessary in this day, in which the advisability of sunlight, a large room, an adjacent bathroom, the absence of all unnecessary draperies, furnishings, rugs, etc., for a proper isolation room are so well understood, to describe the needs in detail. Instruction should be given the family in the minor details of the prevention of infection of others. A properly trained nurse well understands the necessity for burning wooden tongue depressors, wooden swabs,

the gauze and cotton used around the patient's nose and mouth, and washcloths; the use of liquid soap; simple but effective cleanliness of the patient's face, hands, and body; boiling of all eating and drinking utensils; disinfecting the toothbrush with non-poisonous germicides; allowing the bed clothing and bed garments to stand in germicidal solutions before being sent to the wash; frequent washing of her own hands in germicidal solutions; and gargling her own throat with peroxid hydrogen solutions. These are all subjects of general knowledge by physicians and nurses.

B. General Care of Patient.—High fever is not frequent in diphtheria, unless the case has been neglected. Consequently, the patient should receive, almost from the beginning, plenty of nutritious food. The exact diet, of course, depends on the age of the patient. The frequency with which the nutriment is given depends on the amount that is taken; if the nourishment is liquid and in small amount, it should be given every three hours. The food should represent all the elements that the patient needs for nutrition, namely, a considerable amount of protein, a goodly amount of starch, sugar, iron, salt and fruit salts, and plenty of water. Milk, oatmeal gruel, eggs, meat juice well salted, toast, butter, and the whole, or the juice, of one or two oranges, would represent the food needed. With or without meat, it is well to give a diphtheria patient iron, and no preparation is better than the tincture of iron chlorid in 5-drop doses, three times a day, given in fresh lemonade or orangeade, after nourishment.

However well the gastric juice inhibits the growth of the bacteria, it is always wise for a patient to gargle, or be sprayed, before taking food, so that the mouth and throat will be as clean as possible.

The bowels should be moved daily by some simple laxative, if they do not move without such help.

While a diphtheria patient should have plenty of fresh air and all the sunlight possible, he should be kept warm. He should not be allowed to become chilled, as the toxins of this disease cause depression and the patient's temperature may be quite low, and the hands and feet easily become cold. Even if the temperature is high, the bathing should be by warm sponge bath.

C. Antitoxin.—The Revision Committee of the Pharmacopeia will probably decide that the average dose of diphtheria antitoxin should be stated in the next Pharmacopeia as 10,000 units. Recent investigations by Schick[17] show that the dose of antitoxin advisable for ordinary cases of diphtheria can be based on the weight of the individual. Schick finds that 100 units of antitoxin per kilogram of weight is sufficient to combat the toxin in diphtheria in all ordinary cases, and in severe cases 500 units per kilogram is more than sufficient. In other words, enormous doses of antitoxin are not needed, which has long been the belief of Park of New York. This is especially true if the antitoxin is given early. A kilogram equals 2 1/5 pounds avoirdupois, and a child weighing 45 pounds, in an ordinary case of diphtheria, should be given 2,000 units of antitoxin; while if the case is severe, or in nasopharyngeal or laryngeal types, 10,000 units would be all sufficient. By the the same method of decision as to the dose, an adult of about 130 pounds should receive 6,000 units in a mild case, and 30,000 units if the diphtheria is of malignant type, or has affected parts where the danger of absorption is greater.

It seems quite probable that if such doses could be administered on the first day of the infection with the Klebs-Loeffler bacillus, no more antitoxin will be

17. Schick, B.; Kassowitz, K., and Busacchi, P.: Experimentelle Diphtherie Serum-Therapie beim Menschen, Ztschr. f. d. ges. exper. Med., 1914, iv, 83. The Proper Dosage of Diphtheria Antitoxin, editorial, The Journal A. M. A., Dec. 12, 1914, p. 2134.

needed in such cases, and that death from this disease will be reduced to a minimum. It may be wise to give a young child a smaller dose, but it has not been shown, with the concentration of the serums now offered, that locally any harm is done by this injection, or that systemically (except in patients who have received antitoxin in longer or shorter time before, or in patients who are asthmatics or hay fever subjects, or are particularly susceptible to emanations from horses), antitoxin ever does any harm. A slight rash will occur in about half the cases in which antitoxin is used, but such simple eruptions are harmless. The rash may be scarlatiniform in type, or papular, or urticarial. It may occur within a few hours after the injection, or may not occur for some days. If it is in large amount, there may be increased temperature. Mild albuminuria is apparently no more liable to occur from the antitoxin injection than it is from the diphtheria.

The subject of antitoxin injection and dosage has been ably considered by Dr. Woody[18] and by the physicians who discussed his paper. Woody advises that when both tonsils are covered with exudate of more than one day's duration, the smallest dose of antitoxin should be 30,000 units. If both tonsils and the soft palate show membrane, and especially if the nose is involved, and the history shows a duration of three days or more, he would give 150,000 units as the smallest amount. When the nose alone is affected, he believes 20,000 units should be the dose; and in laryngeal diphtheria 30,000 units as the smallest dose is advised. If the case has been a neglected one and there are serious symptoms of toxemia, and especially in nasopharyngeal cases, in which the absorption of toxins is so rapid, he recommends the administration of from 50,000 to 150,000 units. While this dosage seems large, we should note the conclusions offered by

18. Woody, S. S.: The Use of Antitoxin in Diphtheria, The Journal A. M. A., Sept. 5, 1914, p. 861.

Woody after his extensive tabulated experience, namely, that with these large doses there is more rapid local cure and quicker improvement in the patient's general condition, a permanence of the cure, an avoidance of complications, a reduction of mortality, and withal, such dosage is apparently harmless.

Dr. Park of New York, in discussing Woody's paper, advises nearly as large doses, namely, 5,000 units in mild cases, 10,000 in severe, and 20,000 in malignant cases. In toxic cases in which the danger is serious and imminent, he would use the antitoxin intravenously, stating that "10,000 units intravenously is worth 100,000 units subcutaneously." He states his belief that "40,000 units will save any patient that 1,000,000 will."

In a more detailed discussion of diphtheria, Woody[19] brings out some points which we should continually bear in mind. He says: 1. "Diphtheria is essentially a local disease whose harmful effects are produced by certain toxic substances elaborated by the diphtheria bacillus."

2. "The toxin of diphtheria readily reaches all portions of the body by means of the lymphatic circulation." This toxin shows a tendency to attack the kidneys, the nervous system, and the heart. The action of this toxin is inhibited only by the formation of antitoxin in the body, or the introduction of antitoxin into the body.

3. He classifies untoward symptoms following the use of diphtheria antitoxin as: (*a*) Those that occur in eight or ten days after the first injection with symptoms of fever, rash, joint pains, and at times slight albuminuria and edema. In Woody's experience this form of serum sickness occurs in 30 per cent. of the cases of antitoxin injection. (*b*) A similar reaction which may occur after a second dose of antitoxin, provided the source of the antitoxin is the

19. Woody, S. S.: Pennsylvania Med. Jour., February, 1914, p. 339.

same (that is, the same animal has been used), and which will come on more rapidly and be more intense and last a shorter time. (*c*) Anaphylactic shock or collapse, which he has elsewhere stated to be rare, which may occur after a second injection, and occasionally after the first one.

Smith[20] and Park[21] have shown that when antitoxin is given subcutaneously, it takes from three to four days before the maximum amount of antitoxin is circulating in the blood. If the antitoxin is given intramuscularly this period is shortened. From these findings, therefore, the conclusion should be made that if the case is urgent and the toxemia serious, antitoxin should be administered intravenously; if the case is severe and the diagnosis has not been made early, antitoxin should be given intramuscularly; in ordinary or mild cases, and on the first day or two of the disease, it may be administered subcutaneously.

D. Care of the Throat.—It would be just as sensible to perform a major operation with the most perfect technic and yet take no means whatever of preventing infection, as it is to administer antitoxin in proper dose in diphtheria and then to take no proper care of the throat. It should be remembered that diphtheria is primarily a local disease, that the antitoxin combats only the toxins of the Klebs-Loeffler bacillus, that other germs are always found in diphtheritic throat, and that local putrefaction and septic infection readily occur if the throat and nose are not properly treated. While the antitoxin is hastening the throwing off of the membrane or inhibiting its further formation, the surface of this membrane must be washed off or cleansed gently, but frequently. All odor and all danger of secondary infection are removed by proper treatment of the part affected. Although germicdes cannot kill the germs deep in the mucous membrane, or those that are protected by an overlying

20. Smith: Jour. Hyg., 1907, vii, 205.
21. Park: Boston Med. and Surg. Jour., 1913, clxxiii, 73.

exudate, a certain large portion of the surface bacteria are surely killed by as simple a gargle as hydrogen peroxid solution. More active and more irritant germicidal gargles or germicides that are sources of danger when swallowed, are entirely unnecessary in diphtheria.

If the child is old enough to gargle or swash the tonsils, this is the best method of cleansing the throat. If the child is not old enough, thorough spraying of the throat should be done. A solution of one part of the official Aqua Hydrogenii Dioxidi to 3 parts of warm water, freshly prepared each time, should be used as a gargle, every one and one-half or two hours during the day, and every three hours during the night. Three or four minutes after this gargle has been used, it should be followed by some simple alkaline wash, to remove the irritant effects of the hydrogen peroxid. A gargle that may be used for this secondary cleansing purpose is a teaspoonful of boric acid added to ½ glass of warm water. This will not all dissolve, but will deposit on the throat and act as a mild antiseptic. Also, there is no greater promotor of mucous secretion of the throat than boric acid; and the more the mucus is secreted, the quicker will the membrane be loosened. Or, a simple solution of ¼ teaspoonful of salt and ¼ teaspoonful of sodium bicarbonate may be added to ½ glass of warm water. The object of such a gargle and wash is to cleanse the mouth and throat of froth and pieces of membrane, mucus, mucopus, etc., and to soothe the membrane. It is frequently advisable to insufflate boric acid directly on the masses of membrane or exudate. This should be done by the physician.

After the throat has been cleansed all that is possible, it is often of value to apply tincture of iodin to the membrane or exudate. Care must be taken not to touch the healthy membrane with this solution. Lugol's solution may be applied to the parts of the

throat that are not affected, which often tends to prevent development of more exudate or membrane. If there are pockets and crypts in diseased tonsils, after cleansing such, boroglycerid may be applied to heal and to prevent spreading of infection.

As frequent gargling is very tiresome for the throat, swashing is nearly, if not quite, as efficient, and should be suggested. If the child is too young to gargle or swash, the peroxid should be sprayed on, and the solutions for this purpose should be stronger, namely, 1 part to 2 parts of warm water. The cleansing spray may be used afterward. If the throat and mouth generally are irritated, a soothing gargle is as follows:

	Gm. or c.c.	
℞ Acidi borici.....	2	gr. xxx
Potassii chloratis.....	5	ʒ iss
Aquae menthae piperitae....	200	fl℥ vii

M. Sig.: Use undiluted as a gargle, as directed.

Of course, any other flavor than peppermint could be used in this mixture.

Whether or not it is advisable to use a weak hydrogen peroxid solution in nasal diphtheria is a question for individual decision of the physician; generally it is too irritant, even when used weak, and is inadvisable. Cleansing mild alkaline solutions or boric acid solutions represent the most successful treatment of nasal diphtheria used as sprays or snuffed through the nostrils. Such mild, warm solutions may be poured from a small vial or from a teaspoon into the nostril, with the head thrown back. It is inadvisable to use any of the douches that are on the market, or any syphon douche, as the pressure is too great, and fluid is often forced up the eustachian tube or into some of the sinuses. Suprarenal extract may be added to these solutions, if deemed advisable, but it should not be used too frequently. Also, the nose should not be sprayed too frequently.

As soon as the throat is clean, the frequency of the gargles should be diminished, but it should be several

days before the patient is not awakened at night to gargle at least once, or better, twice.

The treatment of the throat advised for diphtheria is equally applicable to follicular tonsillitis or scarlatinal throats, and to septic sore throat.

E. General Medication.—A diphtheria patient requires very little general medication, unless some complications occur. In the beginning a small dose of calomel, or a dose of castor oil may be advisable, and subsequently whatever simple laxative is needed to cause a daily movement of the bowels. The temperature does not often call for treatment. If it is high, or there is headache and backache and general aches, two or three small doses of a coal-tar antipyretic may be given. The following combination for a child 10 years old is efficient:

	Gm.	
℞ Acetphenetidini	1	āā gr. xv
Phenylis salicylatis.....	1	

M. et fac chartulas v.

Sig.: A powder every three hours, if needed.

Later, if the temperature is high, tepid sponging is sufficient, but generally, with the ordinary low temperature of diphtheria, hot sponging for cleanliness and to increase the activity of the skin, and to remove the perspiration, should be done once or twice daily.

As suggested above, every patient with diphtheria should receive iron, either the tincture of iron chlorid, a few drops in fresh lemonade, or a 3-grain tablet of eisenzucker, three times a day, or 0.10 gm. (1½ grains) of reduced iron, in capsule, three times a day. If there is a tendency for the throat or nose to bleed, it can do no harm to add lime water to the diet, and it may be of value.

On account of the nervous depression caused by the toxins of the Klebs-Loeffler bacillus, a small dose of strychnin, not exactly as a cardiac stimulant, but more as a nervous stimulant, is advisable, provided the con-

dition of the patient seems to require it. For a child 10 years old, 1/60 grain of strychnin sulphate, once in six hours, is generally a sufficient dose. If the child is made nervous by strychnin, it should certainly be withheld. A little coffee or tea may be given a child, as a medicine for the action of the caffein, and is of value.

F. Care of the Heart.—Although it was long considered that heart failure in diphtheria was due to vasomotor paralysis, or to action on the vasomotor center, it has been shown by Porter and Pratt[22] that such is probably not the case: that heart failure is probably due to the action of the toxins on the heart itself. Dr. F. W. White of Boston long ago[23] showed that the heart was frequently affected more or less seriously in diphtheria. White also quotes many other authorities showing that myocarditis is not an infrequent complication, that valvular disease may occur from diphtheria, and that even a chronic myocarditis may persist, or a valvular lesion may persist for months or even years, or for life. White and Smith studied the hearts in a thousand cases of diphtheria, and came to the conclusions that moderate disturbance of the heart is very common in diphtheria, and that persistence of cardiac defects often lasts from two to six months; but generally cardiac disturbances from diphtheria become permanently cured. The mitral valve is the one most frequently diseased, and if a lesion is caused, it is generally insufficiency. About 60 per cent. of the patients with diphtheria show an irregular pulse, and the younger the patient, the more liable he is to have this heart irregularity. It may occur even in mild cases. These investigators found that out of 1,000 cases 878 had a heart murmur of some kind at some period of the disease, either at the apex or at the base. The mur-

22. Porter and Pratt: Am. Jour. Physiol., 1914, xxxiii, 431.

23. White F. W.: The After-Effects of Diphtheria on the Heart, The Journal A. M. A., Oct. 21, 1905, p. 1243. White, F. W., and Smith, H. H.: Boston Med. and Surg. Jour., Oct. 20, 1904, p. 433.

murs were generally systolic. These murmurs usually clear up and are not generally significant of valvular lesions. The murmur at the apex is doubtless due to a relative insufficiency of the mitral valve, because of slight dilatation of the left ventricle. In this investigation, necropsies showed that endocarditis and pericarditis are extremely rare complications in diphtheria.

Dr. G. M. Smith[24] reviews more recent investigations, made on the hearts of diphtheria patients. He quotes Rohmer as concluding that in diphtheria, pathologic changes may occur in the auriculoventricular bundle, but that there is no specific action of the diphtheria toxin on the bundle of His. However, diphtheria toxins may so affect the connecting bundle from a functional point of view that heart-block can be produced, even without demonstrable anatomic lesions.

Clinically, the gallop rhythm, with or without vomiting and epigastric pain and tenderness, is a bad symptom in diphtheria. This gallop rhythm of the heart is very serious, and if accompanied by vomiting, the prognosis is very bad. Hume and Clegg,[25] after an investigation of 573 cases of diphtheria, declare that any form of arrhythmia of the heart (except sinus arrhythmia) in diphtheria indicates that the heart muscle or nerves are pathologically disturbed. This may occur even when the diphtheria is apparently mild.

After a patient is apparently well from diphtheria, if he has been severely ill, and especially if the case has been neglected and a large amount of toxins have been absorbed, cardiac failure may occur any time from the second to the fifth week. Symptoms of late cardiac weakness are often a slow, weak pulse. Such hearts, however, become rapid on the least exertion. Such patients are often very pale, and there are liable to be more or less gastro-intestinal disturbances.

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24. Smith, G. M.: A Review of Some Recent Publications on Anatomy and Pathology, Am. Jour. Dis. Child., April, 1913, p. 322.

25. Hume and Clegg: Quart. Jour. Med., 1914, viii, 1.

There can be no question that the effects on the heart in diphtheria are due to the Klebs-Loeffler bacillus toxins; consequently, if antitoxin in sufficient dose is given early, the toxic effect on the heart will probably rarely occur. Consequently, cardiac deaths in diphtheria will be less and less frequent with the early proper administration of antitoxin.

The most important treatment of cardiac complication is rest, and prolonged rest. A patient who has shown cardiac inflammation of any kind, or cardiac irritation during diphtheria, should have a prolonged rest in bed and a very slow convalescence. The small dose of strychnin suggested above as a nerve stimulant is probably sufficient. If the heart is very rapid, it may be unwise to give even this small dose. Larger doses do not seem to raise the blood pressure during illness, and strychnin in large doses as a cardiac tonic, in prolonged weakness, is not so successful as has been thought. In an apparently acute failure, a fair-sized dose, 1/40 grain for a child 10 years old, may be given hypodermically; but to persist in large doses of strychnin is inadvisable. Digitalis is not indicated, and alcohol should not be given. Caffein and camphor may be worth while; but the main thing is absolute rest, small amounts of food, the least possible disturbance for bathing, feeding, defecation and urination, and no prostrating purgatives.

G. After Rest.—A patient who has recovered from diphtheria, however mild it may have been, should have, for the first two weeks, at least, a carefully watched convalescence. Strenuous exercise should be avoided, and the heart should be carefully examined before the patient is allowed to return to his usual work, school, or play.

H. When to Raise the Quarantine.—This has already been sufficiently discussed. Boards of health vary in their requirements. The safest rule would seem to be to release the patient from quarantine after four negative cultures have been taken, at least two

days apart; one of the cultures should be taken from the nostrils. The swab specimens should be procured by a physician, and should be taken several hours after any antiseptic gargles have been used. Also the last culture should be taken from back of the tonsils and from crypts, if any are present.

I. Fumigation.—As stated, formaldehyd or other fumigation is unprofitable in diphtheria, but may be added to thorough germicidal cleaning of the room and its contents. This is a decision for the local board of health.

J. Paralysis.—With the early injection of a sufficient dose of antitoxin, diphtheria paralysis will become less and less frequent. The paralysis of the soft palate, which used to be so frequent, is already becoming infrequent. This paralysis occurs early, between ten and twenty days from the beginning of the illness. The treatment consists of tonics, small doses of strychnin, the best of nutrition, fresh air, sunlight, rest, and prolonged convalescence. The general paralyses, which are now rarely seen, were more serious, and occurred later. They are slow in recovery, and besides general treatment, require massage and electricity.

K. Diseased Tonsils.—Quite probably diseased tonsils cause a susceptibility to diphtheria, as they certainly do to follicular tonsillitis. After complete recovery from a diphtheria attack, when the general condition is perfect, and the heart is in good condition, operations should remove all portions of tonsils that show disease. Whether complete enucleation should be done, or only diseased portions should be removed, and whether or not the capsules should be left, are subjects for an expert decision.[26]

LARYNGEAL DIPHTHERIA

Membranous croup is laryngeal diphtheria, and as soon as the diagnosis can be made that there is exu-

26. French, Thomas R.: New York Med. Jour., Dec. 5, 1914, p. 1097.

date in the larynx or laryngeal region, antitoxin should be given in large dose, without waiting for a decision from the laboratory that the Klebs-Loeffler bacillus is present. The only safe place for a patient with laryngeal diphtheria is a contagious disease hospital, where expert skill in intubation and, if necessary, in tracheotomy can be quickly obtained. The main danger from diphtheria in this location is suffocation.

The toxemia is not great, and the absorption is much less than in nasal, nasopharyngeal, or even in tonsillar diphtheria.

The best of nutrition is important, as exhaustion from labored breathing is likely to occur. The atmosphere of the room is better moist, on account of the membrane becoming dry and causing more obstruction before it loosens and is coughed up. Just how much local steaming of the throat, or inhalation of various medicated solutions should be given, is to be decided by the individual physician. The main advantage is doubtless from the vapor of water.

The main requirements to be remembered in laryngeal diphtheria are the administration of an immediate large dose of antitoxin; intubation by a skilled operator as soon as indicated; a trained nurse skilled in intubation cases, if such can be obtained; the ability to recall quickly the physician who intubated if the tube is coughed up; the immediate removal by the nurse of the intubation tube if it plugs up, and the quick performance of tracheotomy by the surgeon, if such a measure is needed.

SEPTIC SORE THROAT

For some years there have been reported in England epidemics of septic sore throat, some of which have been distinctly traced to infected milk, and all of which probably develop from that source. In the last few years several cities and towns in this country have suffered from epidemics of this character, and in every instance it has been traced to milk from one dairy, and ultimately to one or more diseased cows. The disease that causes such infection is an inflammation of the milk glands, a mastitis, or an inflammation of the udder termed garget. Another possible source for the dissemination of this germ is an infected throat of the milker, or of some one who handles the raw milk.

The germs found in the inflamed udders, in the raw milk, and in the throats of those infected are the same, namely, the *Streptococcus pyogenes*. The largest epidemics have occurred in Boston, Baltimore and Chicago, and in all, about 25,000 individuals have been attacked. The death rate is small, and is due to complications. An epidemic occurring in Boston is described by Winslow,[1] the Chicago epidemic by Capps,[2] and an epidemic in Courtland and Homer, N. Y., by North, White and Avery.[3]

The clinical symptoms have been the same in all of these epidemics, and Capps states that the throats generally show intense hyperemia without a grayish exudate. The cervical lymph glands enlarge, and may suppurate; there is extreme prostration, and a tendency to relapse. The complications are inflammation of the middle ear, abscess around or about the tonsils, and erysipelas or other skin eruptions. The most danger-

1. Winslow: Boston Med. and Surg. Jour., 1911, clxv, 899.
2. Capps, Joseph A.: Epidemic Streptococcus Sore Throat—Its Symptoms, Origin and Transmission, The Journal A. M. A., Sept. 6, 1913, p. 723.
3. North, White and Avery: Jour. Infect. Dis., January, 1914, p. 124.

ous and fatal complication is peritonitis, and there may be fatal septicemia, with localization in the lungs. Endocarditis, myocarditis, arthritis, and nephritis may occur as complications in this septic process.

Means of prevention of septic sore throat in epidemics must include a more frequent bacteriologic examination of the udders of cows and of the throats of those who handle raw milk. Pasteurization of milk would prevent these germs from causing infection.

The treatment of these septic sore throats is not different from that of follicular tonsillitis, namely, dilute hydrogen peroxid solutions 1 : 4, immediate subsequent washings with mild alkaline cleansing solutions, and the local application of a weak iodin solution, as Lugol's solution (too strong iodin preparations might increase the swelling and hyperemia of the throat).

On account of the prostration, the patient should receive plenty of nutriment. The bowels should be moved daily. Pain should be stopped, if it is troublesome, by codein or morphin, if deemed advisable. High temperature should be treated as seems best, and the complications combated as they occur. Infection of others is prevented by the same methods as those described for diphtheria. The blood in this disease should be studied, not only to determine the amount of leukocytosis, and the type that is probably present, but also to determine the amount that gives a favorable prognosis. Such studies may give a clue as to the possible value of an autogenous vaccine.

MEASLES

Measles is probably the most frequent of all infectious diseases, and as many as 25,000 cases have occurred in the city of New York in one year. No age is immune, although infants under 6 months are rarely attacked. Though measles can recur in rare instances, it generally confers immunity for life. That it is considered such a simple, common disease is probably the cause of the large number of deaths from neglect. It is estimated that 12,000 deaths a year occur in the United States from this disease, and the number might be much greater if some bronchial and lobar pneumonias were properly recorded as directly followed by measles. The greatest number of deaths occur in young children. While occasionally a death may occur from the intensity of the disease, generally death is caused by complications in the lungs, abdomen or ear. The complication in the ear is middle-ear inflammation with, at times, an extension to the mastoid. In the lungs the condition may be bronchial pneumonia or pneumonia; or the bronchial glands, which are probably always inflamed in measles, may become permanently enlarged. If tuberculous glands are present, general or pulmonary tuberculosis, if not considered a complication, is frequently caused by measles. The glands in the intestines may become inflamed and cause serious trouble. Inflammation of the cervical glands occurs not infrequently. Nephritis is rare. Hemorrhagic skin eruptions occasionally occur. The urine of patients suffering with measles has been shown to be toxic to guinea-pigs; therefore the toxins of this disease are circulating in the blood and pass into the urine.[1]

In civilized countries the mortality, though varying somewhat in different epidemics, is always greater

1. Aronson and Sommerfeld: Deutsch. med. Wchnschr., 1912, xxxviii, 1733.

where children are crowded into dark, damp tenements, and is often greater in institutions, probably from the fact that physical defects are more or less likely to be present in institutional children, or at least there is often damaged heredity. In civilized communities there has been gradually handed down more or less immunity to malignant attacks of this disease, and it has been observed that when measles first reaches uncivilized communities in which measles has not before been rampant, the death rate is exceedingly great.

Statistics show that the largest number of cases occur in the spring or late fall, and that the sexes are about equally attacked.

Anderson and Goldberger[2] have successfully caused measles in monkeys by using the blood of a patient with measles. They also showed that the nose and throat secretions may infect the monkey, but that positive results could be obtained from these secretions only when they were collected during the period of eruption. While they do not wish their deductions to be considered final, they are pretty well convinced that infection from nose and throat secretions disappears with the approach of convalescence. They did not find that the desquamating epithelium from the skin lesions carried the virus of measles.

Lucas[3] quotes Hecker[4] as finding that the virus that will infect monkeys is in the blood stream of patients with measles twenty-four hours before the appearance of Koplik's spots, and that the virus remains in the blood and can infect monkeys at least thirty-six hours after the appearance of the skin eruption. This emphasizes what has long been recognized, that the greatest infectivity of measles is during the very earliest stages, and generally before the diagnosis has been made.

2. Anderson, J. F., and Goldberger, Joseph: Recent Advances in Our Knowledge of Measles, Am. Jour. Dis. Child., July, 1912, p. 20.
3. Lucas, W. P.: A Review of Recent Work on Measles, Am. Jour. Dis. Child., December, 1913, p. 412.
4. Hecker: Ztschr. f. Kinderh., May, 1911.

Goldberger and Anderson[5] have shown that the virus of measles may pass through a Berkefeld filter, may resist desiccation for at least twenty-four hours, becomes non-infective after being subjected for fifteen minutes to a temperature of 55 C. (131 F.), and will resist freezing for at least twenty-four hours. With these scientific facts it may readily be seen why, clinically, measles is the most contagious, next to small-pox, of all diseases with which we are acquainted, and the fact that it is most contagious almost before the diagnosis can be made renders its prevention very difficult.

EARLY SYMPTOMS

It is essential, if possible, to make a diagnosis of measles before the stage of eruption. After a varying period of incubation, averaging perhaps two weeks, the first stage of measles is evidenced by an acute coryza, attended by considerable sneezing. The eyelids become swollen, and the eyes somewhat inflamed. The tonsils are generally enlarged, and the throat congested. The secretions from the nose and throat are at first serous, and later seropurulent. There is almost invariably some fever from the beginning of this first stage, varying in amount, and it is generally the highest during the first and second day of the complete eruption which, on the average, appears on the fourth day. The usual symptoms of infection are likely to be present, namely, coated tongue, loss of appetite, muscle aches, headache, some lumbar pains, chilliness, and in children sometimes vomiting or diarrhea. With the appearance of these symptoms, measles should always be suspected.

In no attack of acute illness in a child should an examination of the mouth and throat be omitted. A careful examination of the mouth will often show some punctate red spots on the hard palate, and on the

5. Goldberger, Joseph, and Anderson, J. F.: The Nature of the Virus of Measles, The Journal A. M. A., Sept. 16, 1911, p. 971.

mucous membrane of the cheeks will quite generally be noticed Koplik's spots, which are diagnostic. Though early described by other observers, the spots which bear his name were brought to general notice by Koplik in 1896. They most frequently occur on the cheeks near the molar teeth, and at first appear as little darker blotches on the red membrane. Soon in the center of these blotches appears a very small bluish-white speck slightly raised from the surface. These spots never seem to occur on the gums. Although there may be but few of these spots, they are typical and diagnostic of measles. Many times they are not found, but it is probably generally because they have been overlooked, or have been very few in number and minute. These spots may appear two or three days before the eruption on the skin; their diagnostic importance is therefore evident.

One should not be thrown off his guard during the first stage of measles by a sudden dropping of the temperature. This sometimes occurs without any antipyretic, and has not been explained. In other words, the illness seems, apparently, about to cease, and suddenly the temperature again rises, and soon the skin eruption is present.

The blood in measles is more or less characteristic. There is diminution in the number of leukocytes, that is, a leukopenia. Lucas[6] says that early in the infection there is distinct change in the white blood count, and that the greater diminution is in the lymphocytes. He states that a relative diminution of lymphocytes and neutrophilic cells may be noticed a week before any visible symptoms of infection occur, and that the blood will show positive evidence of this disturbance at least forty-eight hours before Koplik spots appear. He also finds a great many disintegrated cells in this blood picture. Lucas[3] also states that different investigators have shown that the eosinophil cells are dimin-

6. Lucas, W. P.: The Value of the Blood Picture in the Early Diagnosis of Measles, Especially in Relation to the Question of Isolation, Am. Jour. Dis. Child., February, 1914, p. 149.

ished, and may even disappear entirely from the blood of patients during the eruptive stage of measles.

In pneumonia, in epidemic cerebrospinal meningitis, and in scarlet fever the leukocytes are increased in number. In typhoid fever and in measles there is a diminution of leukocytes, but in these diseases the greatest diminution is in the polymorphonuclear cells, while the lymphocytes may be relatively increased.

ERUPTION

This is most thoroughly described in all its details by Lucas.[3] The typical eruption of measles is papular, begins from the third to the fifth day (generally on the fourth), and lasts four or five days, the amount varying widely in different cases. It begins on the neck and face, then on the back, and then goes to the shoulders, arms, abdomen and legs. Besides the typical papules, there may be many macules which never reach the papular stage. The spots are generally of a dull reddish color, and somewhat resemble the bites of fleas. They may be irregular in shape and coalesce and form patches. A typical distinction from scarlet fever eruption is that in scarlet fever there is an oval clear space around the mouth. Von Pirquet[7] believes that the eruption of measles depends on the vascularity of the skin, and that the rash appears early and is more intense on the parts of the skin that have a large blood supply, and in parts that are near the large blood-vessels, and he concludes that the rash is the result of a "reaction with the measles organism or virus which takes place in the capillaries of the skin," and may be due to an agglutination of the measles organism by the action of its antibodies.

Prodromal rashes may occur in measles and cause difficulty in diagnosis. There may be an erythema not unlike scarlet fever patches. These eruptions may occur one or more days before the typical eruption of measles. They are generally urticarial in type, and

7. Von Pirquet: Ztschr. f. Kinderh., 1913, vi, 1.

often represent some acute indigestion or food poisoning, or may be due to some drug that has been administered. The diagnosis is made by the catarrhal symptoms, by the blood count, by the Koplik spots, and by the occurrence of the typical eruption of measles.

There is always more or less desquamation after the eruption begins to fade, and the more the eruption, the more the desquamation. It may last for a few days, or may last for one or more weeks. This desquamated epidermis is generally in the form of fine scales.

PREVENTION OF INFECTION OF OTHERS

As stated in the beginning of the discussion of this disease, probably few persons escape an attack of measles. Therefore, up to recent years, before isolation measures were inaugurated, most adults had had measles, and therefore were immune to the disease. With the isolation measures now in vogue, many youth and young adults have never had the disease, and therefore physicians are having more cases of measles to treat in persons who are no longer children.

A large number of cities have now declared that measles is a reportable disease, though placarding of the houses which contain the disease is not general. The isolation required by boards of health varies from fourteen to twenty-one days. A longer period than two weeks seems entirely unnecessary, as it seems probable that infection can be given only in the very early stages and apparently not longer than the stage of eruption, even by the secretions of the nose and throat. The desquamating skin does not carry contagium. Therefore, a long quarantine would seem an unnecessary hardship.

A schoolchild being reported as having measles should cause the other children in the family and tenement to be studied as to whether or not they have

had the disease, and as to how close contact they have had with the infected child. It would seem unnecessary to keep children out of school who have already had this disease, since it has not been shown that there are carriers of this germ. The children who sit in school in the immediate vicinity of the infected child should also be studied, as it is positively known that the most contagious period of the disease is before the eruption, which often means, in mild cases, before it is known that the child is ill. Children who have not had the disease and who have been directly exposed to possible infection from the child who is known to have the disease should remain out of school and away from other children for a period of at least fourteen days.

It has been shown that the contagium of measles, infectious as it is, is transmitted by a more or less close contact. In the wards of hospitals measles has been treated in box compartments open at the top, without giving the contagium to adjoining beds.

The greatest danger of this disease is to young children; therefore when a schoolchild becomes infected, although the disease is almost universal in civilized countries and the majority of mankind has had it or will have it, the greatest of care must be taken that other children do not acquire this disease and later give it to infants in their households. Consequently, careful cleanliness and antiseptic measures should be used in a room in which the infected child had his desk. It is probably rarely necessary to close a school or a schoolroom on account of measles.

Physicians who are in university and seminary or boarding school towns and see a considerable number of the youth of the nation become seriously ill with such children's diseases as measles and mumps, in view of the well-known fact that these simple discases are frequently more serious in older persons than in children, often question the wisdom of preventing the occurrence of such diseases in children.

The answers to such a point of view are: 1. The more cases of measles there are, the greater will be the number of deaths, especially among infants and young children. 2. The more measles there is, the greater will be the number of permanently injured ears, in spite of good treatment.

The present hope must be that the germ of measles will be discovered and that a vaccine will be elaborated that will cause the individual to be as immune against measles as he is now immune against smallpox from cow-pox vaccination.

TREATMENT

In the first place, if the child is very young, the danger from measles is greater. Also, the death rate in the summer months is smaller than in the winter months. This is because this catarrhal disease so readily tends to cause lung and ear inflammations. As seen so frequently in many diseases, typically pneumonia, the mortality in hospital cases of children with measles is greater than in private houses, which means that such children frequently come from the unhygienic atmosphere and surroundings of tenement houses.

A patient with measles must be isolated. The room must be warm, as these patients should not be subjected to cold drafts or cold air. Chilling is especially harmful in measles. This does not mean that the air of the room should not be fresh and clean, and the ventilation the best possible.

A. Eyes.—Unless the child is very young and cannot wear colored spectacles, the room should not be dark. Sunlight is as essential for the welfare of patients with measles as it is in any other disease. It is absolutely unnecessary, in ordinary cases, to have the room black dark on account of the eyes. If the eyes are inflamed, the child will cooperate and really enjoy using colored spectacles. Of course, when it is time

for the child to go to sleep, the room may be darkened, and the glasses removed.

A saturated boric acid solution may be used as a wash on the eyes, and if it seems advisable, some simple eye-drops may be used, such as:

	Gm. or c.c.	
℞ Acidi borici.....	25	gr. v
Aquae camphorae.....	15	fℨ ivss
Aquae .....q.s. ad	25	fℨ i

M. Sig.: Use as eye-drops three or four times a day.

If the lids tend to stick together after sleeping, they should be gently washed with warm boric acid solution or plain warm water, and before the child goes to sleep the edges of the lids may be anointed with thick white petrolatum.

B. Cough, Etc.—If old enough, the child should gargle several times a day with some simple, warm, alkaline sedative solution. If the child is not old enough to gargle, the throat should be sprayed. The nose should also be sprayed occasionally, if it seems stopped up. However, it is often well to leave the nose alone in measles. Most nasal douching is inadvisable, as tending to force fluid or secretions into the eustachian tubes.

Most of these patients require some simple expectorant mixture, although many physicians are losing faith in the activity of so-called expectorant drugs. There is no safe drug that promotes the secretion of the mucous membrane of the upper air passages and bronchial tubes more than does ammonium chlorid. It is of advantage in causing the cough to be less dry, and therefore aiding the expulsion of any mucopurulent matter that may be in the trachea and bronchial tubes. Also, if the cough is excessive from irritation, a sedative should be added to prevent the unnecessary coughing. A child 5 years old may receive the following:

	Gm. or c.c.	
℞ Codeinae sulphatis.....	05	gr. i
Ammonii chloridi.....	3	ʒ i
Syrupi tolutani.....	50	fl ʒ ii
Aquae .....q.s. ad	100	fl ʒ iv

M. Sig.: A teaspoonful, in water, every two or three hours, when the child is awake.

If the child's cough is not excessive or irritable, the codein may be omitted from the mixture. As soon as the expectoration is more free and there is no excessive amount of coughing, the medicine may be stopped. A child 10 years old should receive twice the amount of codein sulphate, and the ammonium chlorid should be increased to 5 gm., and if deemed advisable, the sour sirup of citric acid may be substituted for the sweet sirup of tolu in amount of 25 c.c. to the 100 c.c. mixture.

C. Bowels.—In the beginning of the disease, the child should receive a small dose of calomel, 0.05 or 0.10 gm. (1 to 1½ grains) given with milk; or a dose of castor oil, or some rhubarb or cascara; at least, the bowels should be thoroughly and well moved. Minute doses of calomel frequently repeated should not be given, as such dosage causes irritation and no benefit. Subsequently the bowels should be moved daily with some gentle laxative, if such is needed.

D. Diet.—The food depends on the temperature, and should be liquid and simple as long as the temperature is elevated. As soon as the temperature falls to normal, the child should receive good nutritious food, and plenty of it. It is inadvisable to give meat in any form, including broths, as long as the eruption is present. If, as has been suggested, the eruption in measles is caused by some irritant circulating in the blood, such as occurs in urticaria, representing a sort of anaphylaxis, the proper diet comprises cereals, milk, and plenty of water. Such little patients are better without fruits, as sometimes even orangeade or lemonade seems to cause more itching and discomfort of the skin

E. Fever.—The temperature rarely calls for much treatment. If it is high, however, one or two doses of acetanilid will generally be sufficient to reduce it. Hot sponging will cool the child as much as cold sponging will, and with less disturbance. Cold sponging in measles is inadvisable. As often as the child is bathed or sponged for temperature, the surface of the body should be powdered with some bland talcum.

F. Skin.—Unless the room is cold and damp, or the patient is otherwise ill, a cotton nightdress will cause less itching and discomfort than would a warmer flannel or silk shirt. All through the illness the nurse should recognize that it is the secretions of the nose and throat that cause infection of others, and not the eruption or exfoliation from the skin. This does not mean that it is not necessary to sterilize the child's garments and bedclothing, as such may carry the infection from the nose and throat.

G. Convalescence. — Prolonged, careful convalescence is essential in measles. Measles, like whooping cough, is often a forerunner of pulmonary tuberculosis. Probably no attack of measles ever occurs that does not cause enlargement and more or less inflammation of the bronchial glands. If such glands harbor tubercle bacilli, they are stimulated to cause an acute infection. On the other hand, immediately after an attack of measles a patient is doubtless more susceptible to infection from tubercle bacilli. Therefore, before the child is returned to school the cough should have ceased, his weight should be normal, and his nutrition should be good.

Persistent enlarged glands in the neck or elsewhere, and adenoid conditions or enlarged tonsils, should all be regarded with suspicion. Such conditions are liable to be accentuated by an attack of measles, and proper treatment should be instituted. A suppurating ear must be treated by a specialist until pronounced cured and the hearing is as near perfect as possible. The physician should remember that most defective

ears follow measles, scarlet fever and influenza; that an acutely infected ear, if immediately correctly treated, is generally saved intact; distention and perforation may occur without pain. Consequently, he should be ever alert to see that the complication of middle-ear inflammation is immediately treated.

GERMAN MEASLES (RÖTHELN, RUBELLA)

This is a highly contagious germ disease, most frequently affecting children and youth. It generally occurs in epidemics, but a considerable number of persons exposed to the disease do not acquire it. While the germ has not been discovered, and though it is not known just how it is transmitted, the probability is that the secretions of the nose and throat are the means of spreading the infection. It is doubtful if the eruption or the desquamating epithelium carries the contagium. The stage of incubation is apparently long, averaging perhaps from about ten days to two weeks. The stage of invasion is rarely seen, as when it is first realized that the patient is ill, the eruption is present. The eruption is a maculopapular one, reddish, and rarely confluent. The papules are less raised than in measles; in fact, many points of eruption are purely macules. The color is brighter than that of measles. It occurs first on the chest and face, and then gradually spreads over the body, during the first twenty-four hours. Questioning of the person attacked often shows that there were slight rigors and some backache or headache or feelings of indisposition. The temperature is generally slight, rarely above 100 F.

A diagnostic symptom, enlargement of the post-cervical glands, is almost invariably present, and these are found at the time of the beginning of the eruption. The eruption lasts but a few days, gradually fading, and sometimes leaves points of pigmentation or discoloration for some time longer. There may be considerable fine desquamation, or desquamation may be practically absent.

Complications are rare, and although the patient should be confined to the house, the infection is simple, and there are not likely to be any consequences.

It has been stated that the leukocytes are generally increased in number and that eosinophils are absent or diminished during the period of eruption.[1] More recently, Hess[2] found that "in almost all cases of German measles there was a definite increase in the lymphocytes, even preceding the appearance of an exanthem." Hess suggests that this lymphocytosis at the time of the appearance of the rash may serve to differentiate this disease from scarlet fever. Scarlet fever, it will be remembered, shows an increase of polymorphonuclear white cells in the early stages.

This disease requires, ordinarily, no real treatment. Simple cathartics should be given, the diet reduced, and the patient kept indoors until the eruption has disappeared. If the throat is irritated, an alkaline gargle should be used. The usual simple methods of preventing the infection of others should be carried out.

The disease should be made reportable, as it is so often confused with regular measles, and rarely has been confused with a mild scarlet fever. It is more likely to be confounded with various kinds of intestinal or food poisonings that cause eruption.

1. Arch. de méd. exper., November, 1906.
2. Hess, A. F.: German Measles (Rubella): An Experimental Study, Arch. Int. Med., June, 1914, p. 913.

CHICKEN-POX; VARICELLA

This simple, acute, contagious disease, generally very mild, and rarely requiring any medication or treatment, need not be mentioned here except that it is frequently confused with small-pox. In many parts of the United States the frequent occurrence of small-pox necessitates that every physician should be alert to differentiate these two diseases. The different points of diagnosis between mild small-pox and chicken-pox cannot be better stated than in the paper of Dr. H. W. Hill,[1] director of the Division of Epidemiology of the Minnesota State Board of Health. He states that 10,000 cases of small-pox occur annually in Minnesota alone, and that this large number is due primarily to non-vaccination, and secondarily to mistaken diagnoses, allowing the infection of others. Hill quotes statistics to show that in one investigation over a period of twenty-one years there were thirty times as many cases of small-pox and nearly two hundred times as many deaths occurring in the unvaccinated as in the vaccinated. Health boards should ponder this fact, and then act.

He states that several misconceptions of these two diseases are prevalent, namely, that chicken-pox occurs only in children; that the small-pox eruption does not invade the scalp; that the small-pox eruption alone invades the palms of the hands and the soles of the feet; and that chicken-pox lesions are not umbilicated. All of these points of supposed differential diagnosis are incorrect.

The differential points of chicken-pox and small-pox are as follows:

In chicken-pox: The incubation period is at least two weeks. There is no definite history of a previous attack of this disease. A history of successful

1. Hill, H. W.: Journal-Lancet, January, 1912, p. 1.

vaccination within a few years, or a definite history of a previous small-pox causes presumption that the disease is chicken-pox. There is usually no history of a stage of illness before the eruptive stage. The eruption appears in the first twenty-four hours of the disease, beginning on the back, chest or face, and is most profuse on parts of the skin covered by clothing. The eruption appears in successive crops on successive or alternate days, so that various stages of the lesions may be present at one time. The lesions are round and oval, and the margins are not crenated. The eruption passes through the following stages: 1. Macules lasting a few hours. 2. Soft, superficial papules lasting a few hours. 3. Clear, thin-walled, tense vesicles each lasting a few hours (these vesicles may be readily broken and appear cupped or pitted, and the weeping vesicle then quickly becomes crusted). 4. The crusts, lasting a shorter or longer time, depending on the treatment (each crop completes its cycle from macule to crust in from two to four days). 5. Pitting may occur, but the pits are few, superficial, and often oval.

In small-pox: There is an incubation period of from twelve to fourteen days. There is no definite history of a previous attack of this disease, and no history of successful vaccination within from five to seven years. There is an invasion stage of from two to three days with headache, backache, chills, fever, etc. The first signs of eruption are on the third or fourth day after the onset of symptoms, and the eruption begins on the face and wrists, and is most profuse on the skin not covered by clothing, and the palms of the hands and the soles of the feet are often attacked. The eruption develops in one crop, the lesions appearing steadily from twenty-four to forty-eight hours, the face lesions being usually further developed than those on the body. The lesions are round at all stages, and the margins are not crenated; all those of the same stage of development are usually the same size. The lesions

occur as flea-bite macules lasting twenty-four hours, and then as papules which feel "shotty" under the finger, also lasting twenty-four hours. The next stage is umbilication of the shotty-feeling vesicles, this lasting from twenty-four to seventy-two hours. Next firm, opaque pustules form, each lasting from four to six days, and this formation of pus is accompanied by what is termed the secondary fever of small-pox. Next, firm crusts appear at about the thirteenth day of the eruption, the fifteenth day from the beginning of the disease. Large, dense scabs form with tenacious, dark-colored plaques, which may last days, or even weeks, if the skin is not properly treated. Later, where there is marked pustulation, deep pitting occurs.

It is essential that chicken-pox cases should be early diagnosed, and that the patient should be isolated. A laxative should be given; the diet should be simple and without meat; warm baths, and powder to prevent itching, represent the only treatment generally required. Older patients should be cautioned, and children should be prevented from picking open the vesicles that occur on the face, thus preventing pitting. Young children should wear celluloid mittens.

SCARLET FEVER

No other acute infection varies so much in intensity as does scarlet fever. An attack may be so mild as to be entirely overlooked, or so serious as to make it one of the most dangerous of diseases. The activity of the germ of infection varies in different years and in different epidemics, some epidemics being characterized by their mildness and some by their intensity. This cannot be due to the difference in unprotected individuals, but must be due to characteristics of the germ in different years. Epidemics are most likely to occur in the fall and winter, although isolated cases may occur at any time. As the disease occurs most frequently in schoolchildren, and most frequently in the fall, gradually disappearing in the spring and summer, it is quite likely that the seasonal difference is related to its spread in the schools and the attacking of those who are susceptible, while later in the year all of the susceptibles who have been exposed have had the disease; it then gradually disappears, to begin again on the larger influx of susceptibles into the schools in the fall. Fewer persons are attacked by scarlet fever than by measles or whooping cough, which may show a natural immunity or insusceptibility. On the other hand, some families seem to present hypersusceptibility, such families having the disease in the severest form and with a high mortality. All ages and most peoples are susceptible to scarlet fever, but the large majority of deaths, stated at 90 per cent., are in children under 10 years of age. Young babies up to the age of 6 months, as in most other contagious diseases, are not likely to acquire this disease.

ETIOLOGY

Until recently it was thought that the erupted and desquamating skin carried the contagium of scarlet

fever. Probably, even now, the majority of physicians are unwilling to believe that this disease is not diffused by the desquamating scales. It has been long considered proved that scarlet fever was thus caused because clothing or articles in contact with the patient, after being put away and long disused without sterilization, have caused infection of persons who have later come in contact with these articles. The possibility and fact that secretions from the nose and throat could have contaminated these articles has been entirely overlooked.

A specific germ for scarlet fever has not been discovered. While the streptococcus plays a distinct part in this disease, no form yet isolated has been proved to be the cause. That the infective agent occurs in the mouth and throat has been shown by injecting monkeys with scrapings from the tongue in the early stages of the disease.[1] Friedlander[2] has published a review of the streptococcus findings in the throat and in the blood, and the relationship of such streptococci of the disease to prognosis, etc. It has not been shown that the streptococci found in the throat in scarlet fever are different from streptococci that appear in other inflamed and membranous throats. Park[3] believes that streptococci are only a secondary infection in scarlet fever. Kolmer[4] and many others believe that it has not been proved that streptococcus immunization has any value as a prophylactic measure against this disease.

A fusiform bacillus has been found in the throats of scarlet fever patients by Klimenko.[5] He also found this bacillus in the spleen and liver of five out of seven children who had died of scarlet fever. The exact

1. Jampolis, Mark: Résumé on Infectious Diseases, Am. Jour. Dis. Child., June, 1912, p. 406.
2. Friedlander: Interstate Med. Jour., January, 1913, p. 55.
3. Park: Arch. Pediat., June, 1912.
4. Kolmer, J. A.: Studies of Streptococcus Antibodies in Scarlet Fever with Special Reference to Complement Fixation Reactions, abstr., The Journal A. M. A., Dec. 9, 1911, p. 1942.
5. Klimenko: Russk. Vrach, xiii, No. 8.

relationship of the bacillus to scarlet fever of course has not yet been determined.

Koessler,[6] after reviewing experimental study in this disease, concludes that "the serum of scarlet fever patients contains specific antibodies for an unknown virus," and that "this unknown virus seems to be present specifically in the cervical lymph nodes." Schultze[7] of New York first described a certain micrococcus which he had found in the throats of scarlet fever patients. It is stated that this micrococcus, which has been termed the "Micrococcus S," has been found in the mouth only in the early stages of the disease, and it is believed that this would prove that scarlet fever was contagious only during the early first stage. The organism was not found in the purulent discharges, or in the blood. While this coccus has been carefully described, it is admitted that it is distinguished at times with difficulty, and Ferry[8] states that it must be differentiated from the *Micrococcus catarrhalis,* the *Micrococcus tetragenus,* the *Micrococcus pharyngis siccus* and from the *Diplococcus intracellularis meningitidis.* It has not been proved that the Micrococcus S is the cause of scarlet fever, or that vaccines made from this germ, or from this germ and streptococci, or from streptococci, have curative action in scarlet fever, or have immunizing powers against scarlet fever.[9]

To sum up, we must declare that the germ of scarlet fever has not yet been discovered; that there is no doubt that the disease is spread by the secretions of the mouth, throat and probably nostrils; that the skin does not spread the contagium except as it becomes contaminated with these secretions; that the streptococcus plays a large part in the clinical course of the disease of scarlet fever, and that a patient may develop an actual septicemia, and this septicemia is frequently

6. Koessler, K. K.: Recent Advances in Our Knowledge of Scarlet Fever, THE JOURNAL A. M. A., Oct. 26, 1912, p. 1528.
7. Schultze: Med. Rec., New York, Dec. 10. 1910.
8. Ferry: Med. Rec., New York, May 23, 1914, p. 934.
9. For some apparently satisfactory results see the Medical Record, New York, May 23, 1914, two papers.

the cause of death. It certainly is a frequent cause of complications.

It is thought that scarlet fever is not infrequently caused by the milk of diseased cows, and some epidemics of sore throat with eruption have certainly presented all the marks of scarlet fever. It should be remembered, however, that septic sore throat has been scientifically traced to diseased cows, and that in septic sore throats, scarlatiniform as well as other eruptions not infrequently occur. It is probable that household pets, as cats and dogs, may transmit the contagium of scarlet fever.

The secretions of the mouth that carry the germ of this disease may infect any article that comes in contact with the patient, and this specific germ, whatever it may be, can apparently live for a long time in spite of heat, cold, drying or moisture, and cause infection months, if not years, later.

The incubation period of this disease is shorter than most of the other contagious diseases, and may be as short as one day, with an average of about three days. If the disease does not occur in the course of a week after exposure, the individual will apparently not acquire the disease from that contact.

PROPHYLAXIS

This primarily presupposes an early diagnosis, and such a diagnosis may be very difficult in atypical and mild scarlet fever. No single symptom can be depended on as diagnostic, and any one or more symptoms may be absent. An association of a reddened throat and a strawberry tongue and an eruption typical of scarlet fever appearing in twenty-four hours, with fever, of course makes the diagnosis positive. Food poisoning may cause an eruption similar to that of scarlet fever, but would not cause the reddened throat. The eruption of measles comes much later in the disease. The eruption of German measles may simulate the appearance of scarlet fever and is found

early, and the diagnosis of German measles from a very mild scarlet fever may be difficult unless other cases of German measles have occurred, and contact with such was positive, and the postcervical glands were enlarged; such a mild case of illness and eruption should be considered scarlet fever until proved to be caused by some other disease. Even a history of a previous attack should not prevent the suspicion, as scarlet fever can occur more than once in the same person.

The following diagnostic test was first suggested by Rumpel, in 1909, then more carefully described and recommended by Leede,[10] and reported by Jampolis[1] as being present in 199 out of 200 cases. On account of having been found in a considerable percentage of well persons, it cannot be considered pathognomonic, but only a suggestive diagnostic sign. The test is made as follows: A passive hyperemia is caused by a broad rubber band placed around the arm, just above the elbow joint, not sufficiently tight to obstruct arterial flow. This band is loosened in about fifteen minutes, and the skin on the inner surface of the elbow joint, on being stretched until it appears anemic, will show petechiae if the reaction is positive. It has been suggested that this phenomenon is caused by changes in the walls of the capillaries. A negative reaction is perhaps a greater indication that scarlet fever is not present than is a positive reaction that it is present. It has not been shown that such a test would not be positive in various anaphylactic conditions.

It has not been shown that any vaccine or antitoxin is of value in preventing or curing scarlet fever.

Much more interesting, and with greater promise of value, is the report of W. S. Barker[11] of St. Louis that the blood serum of patients who have had scarlet fever may be of value when injected into those who are ill with the disease.

10. Leede: München. med. Wchnschr., 1911, lviii, 293 and 1673.
11. Barker, W. S.: Arch. Pediat., August, 1914.

The general prevention of this disease in schools is very similar to the methods suggested under diphtheria, namely: As soon as a case of scarlet fever is reported to the board of health and board of education, other children in this family, children in the same house or tenement, the child's playmates, and the children who are in close contact with the infected child, either in the schoolroom or in classes, must all be under suspicion. There is no object in taking any swabs from the throat, if the diagnosis of scarlet fever is positive, as no specific germ has been determined. The throats and tongues, however, should be inspected, and the temperature taken, and a record made of all possible contacts with the infected child within at least forty-eight hours of the child's becoming ill. It should be ascertained how many of these contacts have already had the disease, although, as previously stated, it not infrequently occurs more than once in the same individual. These contacts or possible contacts should not be allowed in school until one week from the time of their possible exposure. Children of the family, and frequently those from the same house, should not be allowed to attend school during the quarantine of the one infected unless they are sent to live in some other house or building. The measures taken to cleanse and clean the room in which the infected child sat are the same as described in diphtheria and measles. Fumigation is not needed. If more than one child in a given schoolroom comes down with the disease, that room might well be closed for a period of one week, not that the room could not be thoroughly cleansed of the infective germ in twenty-four hours, but lest "missed" or mild cases in this room will cause the disease in others. As soon as a week has passed, children who are well, and have not again been exposed to the disease, may return to school.

The quarantine of a child's home, or of the person infected, is of course that prescribed by the board of health of the city or town in which the patient lives.

It has been the rule to continue the quarantine for from five to ten days after desquamation has ceased, and in some cities from six to seven weeks is the term of isolation ordered by the boards of health. Unless we believe that the skin disseminates the disease, such a length of time is entirely inexcusable and unjustifiable. Quarantine should be raised as soon as the throat is well, as soon as the fever has entirely disappeared and the acute eruption has ceased. When desquamation is well established or should have occurred (sometimes it occurs very late), the patient should be released from quarantine, the placard removed from the house, and the other children in the family allowed to return to school. The desquamating child should not attend school because he is in the midst of his convalescence and is not yet safe from possible nephritis.

Although in all probability the infective germ does not live long in the secretions of the throat after the acute stage is over, it has been thought that continued suppuration, whether in the tonsils, nose, sinuses, ear or glands, could cause scarlatinal infection of others. This is probably doubtful; but children with such suppurations should not only be properly treated and of course excluded from school, but also kept for a time from playing with other children.

There seems to be no good excuse for preventing the wage earners of a family in which the patient is at all properly isolated from attending to their ordinary vocations. A schoolteacher, a nurse, an attendant on other children, or one who is employed in some public institution should stop work temporarily, but after one week of observation without other contact with scarlet fever they may be allowed to resume.

In view of the belief that the infection occurs in the mouth, throat and nose, persons exposed to this disease should use gargles or sprays in the throat and sprays in the nostrils of some mild antiseptic solution three or four times a day for at least four days.

SYMPTOMS

This disease has a rapid invasion, except in very mild cases, with fever, sore throat, not infrequently vomiting, and there may be a convulsion in young children. The condition of the throat and the height of the temperature will give a quite definite indication of the severity of the disease, although mild cases may have very serious or troublesome complications. On the other hand, the temperature may be very high, and the type of the disease may be malignant.

Typically the eruption appears at the end of the first day, but may be present when the patient is first seen. It generally begins on the neck and chest (it may begin on the abdomen, or in the groins and axillae) and rapidly spreads over the whole body, and in a typically severe case the patient presents a scarlet hue from the forehead to the feet, and in this form the eruption is unlike that of any other disease. This bright color may gradually become darker, and in two or three days begins gradually to disappear. At its height the skin is markedly hyperemic, and any pressure renders it pale and anemic; but on removal of the pressure the color instantly returns, which is quite characteristic of this eruption. As soon as the acute stage of the eruption is past, the skin becomes rough and dry, and sooner or later desquamation begins, ordinarily the rash having entirely disappeared at the end of about a week. Punctate eruptions may be found in the roof of the mouth, very different from the Koplik spots found in measles, and the same reddish points may be found in the armpits and groins.

Unfortunately, the typical eruption described is often not present. The eruption may occur in patches, or on the chest only, or on or around some of the joints, and in mild cases the color of the eruption is not typical. Various irritations caused by food or drugs and various septic poisonings may produce eruptions that simulate that of scarlet fever. Frequently a doubtful case may be diagnosed by an associated

inflammation of the throat, sore throat being absent in food and drug poisonings; but a septic sore throat may be associated with scarlatiniform eruption on the chest and abdomen. The cause of this eruption in many cases, however, is doubtless the drugs that have been administered, such as salicylic acid in some form, or some coal-tar product, or perhaps quinin. Some slight papular eruption may occur in scarlet fever, and there may be petechiae, and if the disease is malignant there may be large ecchymotic patches.

Many attacks are so mild that the diagnosis has not been made until desquamation begins; and, unfortunately, even desquamation may not occur, although desquamation may occur without much rash or eruption. Not infrequently a second desquamation may occur after the first has been practically completed. If the inflammation of the skin has been severe, not infrequently the epidermis comes off in pieces and patches, especially on the palms of the hands and the soles of the feet. Desquamation usually begins on the part first erupted, namely, on the chest and neck. It may be prolonged and tedious and last several weeks.

The characteristic tongue and the characteristic throat of scarlet fever need not be described, especially as they so greatly vary in appearance. The typical strawberry tongue may not be present. Also Kerley[12] states that the strawberry tongue is of little value: "I have seen it in many other illnesses." The inflammation of the throat may vary from simple redness of the tonsils, pharynx and soft palate to masses of membrane in these regions and in the nasopharynx. These so-called anginoid cases are always serious and more likely to cause complications and septicemia. It may well be noted here that it has been repeatedly stated that scarlet fever may occur without any eruption on the skin; therefore a suspicious throat and tongue, with diphtheria excluded, may be an atypical scarlet

12. Kerley, C. G.: Personal Observation in Scarlet Fever, The Journal A. M. A., Oct. 24, 1908, p. 1407.

fever. However, with our better understanding of septic sore throat, real scarlet fever without eruption is probably exceedingly rare.

The fever does not always cease with the eruption, and the patient may have a more or less prolonged, tedious fever, even without definite complications. Generally this fever is due to a septic suppurative process, and will persist until the pus is evacuated, whether it is in a gland, a sinus, an ear or elsewhere. Nasal and nasopharngeal inflammations cause the temperature to persist long. Relapse in scarlet fever is rare.

THE BLOOD

A few years ago Döhle[13] stated that he had found in the blood of thirty scarlet fever patients "certain inclusion bodies" in the polymorphonuclear leukocytes, and thought that they might be pathognomonic of scarlet fever. He did not find these after the sixth day.

Kretschmer[14] confirmed Döhle's findings, and Nicoll and Williams[15] also found these bodies in the blood smears of a majority of scarlet fever patients, namely, forty-five times in fifty-one cases. That these bodies are pathognomonic of scarlet fever was soon denied by Ahmed,[16] who found them in other septic processes. Later, MacEwen[17] showed that without doubt streptococcic infection plays a positive part in causing these inclusion bodies, but that a differential diagnosis of scarlet fever from measles and German measles may be aided by finding these bodies in conjunction with a leukocytosis. In measles, it will be remembered, there is a leukopenia. Still more recently, Isenshmid and Schemensky[18] have concluded, after reviews and investigations, that these inclusion bodies are found in the polymorphonuclear leukocytes in practically all cases of scarlet fever in the early stage. They are not found

13. Döhle: Centralbl. f. Bacteriol., Nov. 23, 1911.
14. Kretschmer: Berl. klin. Wchnschr., March 11, 1912.
15. Nicoll and Williams: Arch. Pediat., May, 1912.
16. Ahmed: Berl. klin. Wchnschr., June 24, 1912.
17. MacEwen: Jour. Path. and Bacteriol., 1914, xviii, No. 4.
18. Isenshmid and Schemensky: München. med. Wchnschr., 1914, lxi, 1997.

in diphtheria, measles, German measles or whooping cough. They may be found in pneumonia, and perhaps in various septic infections. These inclusion bodies may be of different forms, but the most characteristic form is triangular with a long tail-like end.

There is always a leukocytosis of the polymorphonuclear cells in scarlet fever. It begins early, reaches its maximum at the height of the disease, and then gradually diminishes, unless there is some septic complication. If the leukocytosis is high, the disease is either very severe, or there is pus formation somewhere. Tileston, in his investigations of the blood of scarlet fever patients, found that the eosinophils were diminished at the height of the fever and eruption, and gradually returned as the rash disappeared. He did not find that any prognostic inferences could be made from the number of eosinophils as suggested by Bowie.[19]

Dick and Henry[20] have found that the kind of organisms present in the throat and in blood cultures have also been discovered in the urine of scarlet fever patients, and they suggest that possibly the frequency of nephritis is due to the excretion of these living bacteria through the kidneys.

COMPLICATIONS

Complications are so many, and some of them occur so frequently, as to be almost a part of scarlet fever, and as many times they are the cause of death, they deserve more than passing mention. The seriousness of anginose scarlet fever has already been mentioned. The treatment of such a septic throat is not different from that already described for diphtheria. Nasal inflammation is a frequent concomitant symptom of serious scarlet fever, and frequently one or more of the adjacent sinuses are affected. Even in young children in whom the sinuses have been considered anatomically unimportant, they are likely to become

19. Bowie, J. M.: Jour. Path. and Bacteriol., March, 1902.
20. Dick and Henry: Jour. Infect. Dis., July, 1914.

infected, not only the maxillary sinus and the ethmoid cells, but even the frontal and sphenoidal sinuses. Hubbard[21] discusses these sinus complications, and quotes Killian as believing that some form of sinusitis is nearly always present when there is any severe rhinitis in scarlet fever. The danger of these inflammations of the various sinuses, especially of the ethmoidal and sphenoidal cells, is that a septic phlebitis or meningitis may occur, which conditions are of the most serious prognosis. Hubbard states that "meningeal invasion is less likely to follow ethmoidal than frontal sinus empyema." Even at the best when one of the sinuses adjacent to the nostrils becomes inflamed and suppurative, the condition is likely to become chronic and to heal slowly, even under the best treatment, to say nothing of the danger of bone necrosis.

Any method of treatment of the nose and throat that prevents clogging or blocking of discharges in the nose or nasopharynx tends to prevent sinus complications and middle-ear complications, and the frequency of the latter (namely, middle-ear inflammation) in scarlet fever is too common to require comment.

Next in frequency to nose and ear complications are involvement of glands of the neck. These glands readily suppurate during, or after, scarlet fever. This is distinct from the enlargement or inflammation caused by diphtheria. With no other apparent cause for the persistence of fever, when the eruption is abating, an enlarged gland should cause suspicion (especially if there is an increase in leukocytosis), that pus has already formed in this gland.

While albuminuria is frequently present during the height of the temperature, the complication of nephritis is not likely to occur before the end of the second week, and may even occur as late as the fourth week, and this complication not infrequently occurs after mild attacks of scarlet fever. Nephritis is stated to

21. Hubbard, Thomas: Accessory Sinus Suppuration in Scarlatina, Am. Jour. Dis. Child., July, 1911, p. 11.

occur in from 10 to 20 per cent. of all cases. While a mild albuminuria and even a few casts may not infrequently be found, a real attack of a complicating nephritis is always serious. The concomitant symptoms are those of nephritis, and the prognosis and treatment is that of acute diffuse nephritis.

Cardiac complications of scarlet fever are not frequent, but in septic cases serious endocarditis or pericarditis may occur. Not infrequently one or more joints may be attacked and may suppurate. Suppuration of the joint is a serious complication.

TREATMENT

A. Isolation.—Strict isolation measures, already discussed under other headings, are most important in this disease, and the nurse should distinctly understand that it is the secretions of the mouth and nose, and perhaps suppurating complications, that carry infection. Also, she should understand that the greatest possible care to disinfect or sterilize articles contaminated by such secretions should be exercised, as the infecting germ is persistent and lives for a long time unless killed. The best equipment of the most appropriate room available for the care of the scarlet fever patient needs no further discussion. Sunlight is essential, as in all infectious diseases. The most efficient cleanliness of the patient, the nurse, and the physician who handles the case is also essential. If a child in a tenement house or in a house where there are other children cannot be properly isolated, he should be sent to a contagious-disease hospital, if there is such.

B. Diet, etc.—As in the beginning of all diseases, especially the infectious diseases, the bowels should be thoroughly evacuated with castor-oil, calomel, or whatever the physician deems best; subsequently, they should be moved daily by some gentle laxative, found efficient. If the patient has diarrhea, it is generally caused by a mistake in the diet. Milk is the best

basis for the diet in scarlet fever. Intestinal indigestion is not frequent. Foods that add products to the blood that during excretion are likely to cause irritation of inflamed kidneys should be avoided.

It is open to discussion whether a mild nephritis is a complication of scarlet fever or a part of the disease. We believe it is a part of the disease, and a logical part of it. Whether germs or toxins are excreted by the kidneys and irritate them, as has been suggested, it is certain that when the skin of one-third or more of the body is inflamed, becomes dry and does not properly secrete or excrete even water, the kidneys almost invariably become irritated, if not inflamed. Theoretically, the more intense the inflammation of the skin, the greater the amount of desquamation, the greater the amount of chilling of the body, and the greater the amount of decomposition products of protein metabolism, the more the liability to nephritis. The aim of the physician, therefore, should be to diminish the inflammation and irritation of the skin, to keep it warm, to attempt to keep it moist and promote its secretion, and to give a diet rather low in proteins and without meat, meat extractives or purins. Also, if possible, no drugs should be administered that tend to irritate the kidneys, especially after the first week of the illness. Such drugs are coal-tar products, synthetic products, caffeins, and any of the drugs that are known as stimulant diuretics. Even drugs that contain salicylic acid should be avoided.

The diet, then, in scarlet fever first depends on the amount of fever and the severity of the illness. The greater the intensity of the disease, the more liquid the diet should be. While milk is the basis, thin cereal gruels are advisable from the start. It should not be forgotten that death in many an acute disease is now known to have occurred from acidosis, due to a protein and albuminous diet and to withholding starches and sugars. Malted milk may be

added to this diet, and lemonade or orangeade or oranges, as deemed advisable. Later, toasted bread, crackers, and various kind of cereals, and still later, baked potato, rice, corn starch, and many other cereal and milk foods, as well as a greater variety of fruit, should constitute the diet.

As soon as the convalescence is established, and even before, if the disease is prolonged, a small dose of iron should be given daily, as on the above diet the blood cannot get this nutriment. A sugar of iron (saccharated oxid of iron) 3-grain tablet should be given from one to three times a day. Sodium chlorid should always be given a patient from the beginning, once or twice a day, in one or more of the feedings. If there is a tendency of the nose and throat to bleed, or there are hemorrhages in any other part of the body, lime-water should be added to the diet. The patient should always receive plenty of water. If any apparent irritation of the kidneys occurs, it may be well to withhold some of the fruits and to temporarily diminish the amount of food.

C. Fever.—The temperature can be very high in scarlet fever and represent a dangerous factor in the disease. If the bowels are properly moved, and the diet is carefully regulated, and the throat, nose and nasopharynx are kept as clean as possible to reduce the secondary streptococcic infection, the temperature will be much lower than when these causes of increased temperature are neglected.

If the temperature becomes very high it may be advisable to give several doses of an antipyretic, such as acetanilid, antipyrin, or acetphenetidin, always bearing in mind the irritant effect of these drugs on the kidneys. Hot sponging of the body will also tend to reduce the temperature and make the patient comfortable. It relieves itching, and many times is soothing. Cold sponging in scarlet fever is inadvisable and uncalled for. If the fever is excessive, tepid sponging may be tried. Restlessness and sleeplessness

will also increase the fever, and often a few doses of sodium bromid will be of great benefit. It not only causes the patient to sleep, but reduces the irritability of the peripheral nerves. Also, anything that relieves itching or burning of the skin will reduce the temperature and the irritability. Quinin is inadvisable, as it is excitant to the brain and may tend to congest the ears and add one more element that may cause middle-ear complications. An ice cap to the head, unless actual meningitis is present and the hair is clipped close to the scalp, is inadvisable. Whether ice caps to the head ever reduce general temperature is open to grave doubt. If there is meningitis, they may relieve the local congestion. We doubt if they are ever of much value in general high temperature. In this form of treatment the ice cap should be applied whenever the patient is sponged with cold water. Ice caps, however, tend to fall to one side or the other of the head and unnecessarily chill the ears, and may become another factor in causing middle-ear inflammation. The value of an ice bag over the mastoid when it is in danger is not under discussion; but an ice cap over an external ear is not called for, and may do harm.

D. The Throat and Nose.—Antiseptic, alkaline and cleansing gargles and sprays for the throat and nose are not different from those described under diphtheria. The value of boric acid, both in mixture and as insufflated powder, is the same as in diphtheria. The cleaner the nose and throat in scarlet fever, the less the secondary infection, the less the toxemia, and the less the danger. Whatever method is used to clean the nostrils, such pressure of the liquid as would tend to force infection into one or the other of the sinuses must never occur. If there is no purulent discharge from the nostrils, it is inadvisable to spray or douche them, as much harm can be done from too strenuous or unnecessary treatment of the nose.

E. The Skin.—Whatever the temperature, hot sponging for cleanliness once or twice a day is of advantage, is soothing, and advisable. Whatever the temperature, sponging with alcohol in any form is inadvisable. Alcohol, unless the solution is so dilute as to represent not alcohol, but only an alcoholic odor, will tend to dry the skin, cause more itching, and more discomfort. The more moist the skin, or the more natural oil that is excreted on the skin, the healthier it is. Also, we believe that the less the skin is dried and rendered nonsecreting, the less likely is the danger of a kidney complication. Sometimes sponging with bicarbonate of soda in warm water soothes the irritability and stops the itching. Powdering with some soothing talcum powder often stops itching and quiets the patient.

As soon as the acute eruption is over and desquamation is about to begin, the gentle rubbing into the skin of some bland oil, as cocoanut oil or almond oil or wool-fat, sometimes with a little glycerin and water, hastens the removal of the dried epithelium, prevents scales from flying about (although these scales do not carry the contagium) and is very quieting to the patient, by preventing the irritation and itching. As soon as convalescence is established, a more active massage of the skin and muscles is advisable.

The use of mercuric chlorid or phenol solutions of any strength, or phenol ointments, on the skin, is inadvisable and inexcusable. Most of these solutions tend to dry the skin still more; the use of phenol ointment might result in some absorption and therefore is of danger to the kidneys. Also, as it seems to be a fact that the contagium is not spread by the skin, there is absolutely no excuse for germicidal ointments or applications.

Unless the temperature is very high and head symptoms are present, it is unnecessary to cut the hair close to the scalp. If the scalp itches, as it often does, some simple sedative solution may be used,

Later, a simple gentle shampoo may be given and a little petrolatum rubbed into the scalp. A tar soap may stop the itching. Oil of eucalyptus has been recommended and used as a non-irritant application to the skin and scalp. Also, throats have been swabbed with oil of eucalyptus preparations, in the belief that eucalyptus oil is especially antiseptic in throat contagions.

F. The Heart.—Cardiac stimulation, especially in children, is rarely needed in this disease. The toxin of this disease is not as depressant as is that of diphtheria, and strychnin is generally inadvisable as it causes too much cerebral stimulation, especially in children. Death from this disease generally occurs by its very intensity, or from some complication, and is not from prostration and shock. In the malignant or fulminating form of this disease, in which death may occur on the first or second day, the temperature is generally excessively high, and the pulse may be rapid and feeble, but stimulation of the heart would even then be of but little value. Patients afflicted with this type of scarlet fever often have convulsions, and generally die in coma. Such deaths are often like a fulminating cerebrospinal meningitis.

On the other hand, if a long septic process follows scarlet fever, or there is later a septicemia, small doses of strychnin may be of value, and alcohol is of value as not only adding a food, but as tending to prevent a dangerous acidemia. Also, in such septic conditions, as much carbohydrates should be given as the patient can digest.

If joint complications occur, there is more likely to be an endocarditis, and perhaps chorea may develop.

G. Later Complications.—Inflammations in the nose and its adjacent sinuses have already been sufficiently discussed. *Middle-ear inflammations* should be expected and watched for. The drums should be early punctured if there is pressure, and the services of an expert on diseases of the nose, throat and ears

should be early sought by the physician, if any of these complications occur.

It may here be emphasized that it has been proved that hexamethylenamin (urotropin) can be of no value in these throat, nose, sinus, ear, or even meningitis cases as it will not furnish formaldehyd and therefore cause antiseptic action, except in acid secretions or solutions. Also, it is a fact that it can more or less irritate the kidneys; therefore, in scarlet fever throughout its entire course this drug should not be given.

The *glands* of the neck are almost always congested and enlarged in scarlet fever, and one or more may tend to suppurate. It often seems that the local application of a proper-sized ice bag to a gland, if the patient will tolerate such an application, aborts serious inflammation. However, if such a suspicious gland continues to enlarge, the temperature rises and blood counts show an increasing leukocytosis, there is probably pus formation, and the gland should be soon opened. The surgeon, however, often decides that he prefers to have warm applications for a short time to cause more rapid breaking down of the central suppurating portion of the gland, so that more complete evacuation may occur on incision. The subsequent dressings and treatment of such an abscess are purely surgical. The temperature will generally drop after the evacuation of the pus, unless there is some other localized septic process.

Although the percentage of occurrence of *nephritis* in or following scarlet fever is not great, it occurs sufficiently often to be always looked for and expected. As above urged, all drugs that irritate the kidneys, and all foods that cause irritation should be withheld. While it has not been shown that meat will cause nephritis, it is not necessary to add meat to the diet in scarlet fever. Many believe that eggs should not be allowed. The withholding of eggs as a preventive of nephritis hardly seems necessary. Some physicians even withhold salt from the food; this does not seem

necessary. If the amount of urine greatly diminishes and albumin appears, there may not be an actual nephritis, but it may be well to attempt to forestall or abort such an inflammation. Hot packs or applications to the lumbar region can do nothing but good. A general body sweat is entirely inadvisable, and the value of profuse sweating in uremic conditions is even quite doubtful. Perhaps the best preventive of nephritis is prolonged rest in bed for at least a week after the fever has ceased, as it seems to be a fact that the better the action of the skin, the less likely are the kidneys to become inflamed, and the skin will be warmer, and is likely to be more moist in bed than when the patient is about. Chilling of the body following scarlet fever is an important added cause for the development of nephritis. Also, if the kidneys have been sufficiently irritated to cause a distinct predisposition to nephritis, an increased use of the muscles, whether by playing, exercise, or work, too soon after the acute symptoms are over, may so increase the excretory substances from muscle metabolism as to add a very tangible factor to further irritation of the kidneys and consequent nephritis. If nephritis develops, the treatment becomes that of acute Bright's disease.

H. Convalescence.—As just suggested, the patient should remain in bed one week after the fever has ceased, and the subsequent convalescence should be prolonged and carefully watched. During the acute stage of the disease the urine should be examined daily, to note the first appearance of albumin and how long it persists. During the convalescence the urine should be examined at least every other day for two weeks, and once or twice a week for several weeks more. The diet should be increased and most foods allowed, except that it may be well for at least two weeks not to give meat. During this period the patient should continue to receive iron. A simple bitter tonic may be advisable to stimulate the appetite.

If the weather is cold and damp, great care must be taken that the patient be not exposed.

Just how long the germ of infection persists in the mouth, and especially in the nose, has not been determined, but secondary cases can occur when the patient, especially if he has a nasal discharge, has been allowed to play with other susceptible children. It was long thought that the desquamating skin was the cause of this late infection of others.

As it is conceded that streptococcic infection is concomitant with the cause of many of the complications of scarlet fever, vaccine treatment with stock vaccines or autogenous vaccines has been suggested and advised to hasten the eradication of left-over septic processes. The same rules and regulations, and the same frequency of success will doubtless occur in the septic processes following scarlet fever as with any other septic process.

SO-CALLED SURGICAL SCARLATINA

Although this name has long been given to eruptions that occur during a septic infection, it is very doubtful if they bear any relation to scarlet fever. If real scarlet fever occurs after an operation, the infection probably had nothing to do with the operation or the septic process. That the eruptions from septic processes are probably not scarlatinal was well proved ten years ago by Alice Hamilton.[22]

22. Hamilton, Alice: Surgical Scarlatina, Am. Jour. Med. Sc., July, 1904, p. 111; abstr., THE JOURNAL A. M. A., July 23, 1904, p. 283.

CEREBROSPINAL FEVER

EPIDEMIC CEREBROSPINAL MENINGITIS; SPOTTED FEVER

This disease occurs in epidemic and sporadic forms, the latter form being often difficult to diagnose. The epidemics are generally small in number of affected persons and more or less localized. While young children and young adults are most often attacked, it occurs not infrequently in camps, or in other groups of closely associated individuals. Hardship, privation, exhaustion and poor sanitation seem to allow it to occur. The sporadic form is always more or less present in most cities, and so-called "basillar meningitis" is doubtless generally this disease. Some epidemics in cities show a large number of very young children affected by it. Epidemics appear, both in this country and in Europe, most frequently in the winter and spring months, and the greatest number of sporadic as well as epidemic cases occur during March, April and May.

ETIOLOGY

The cause of epidemic cerebrospinal meningitis is the *Diplococcus intracellularis meningitidis,* also called meningococcus, which was first described by Weichselbaum, in 1887. These cocci are found in the spinal fluid. In appearance they are very much like gonococci, and lie in pairs either in or near the leukocytes. These germs are also found in the secretions of the nose and nasopharynx. They have been found in the blood stream, in the lungs, in the joints, and in other parts of the body. The meningococcus is of low vitality and is readily killed by sunshine, drying and by freezing; therefore, with ordinary precautions the danger of contagion is slight. As in so many other diseases, carriers of this germ have been found, and they probably play a considerable part in the spread

of epidemics and in the occurrence of sporadic cases. In those suffering from this disease the germ has also been found in the conjunctiva, and even in the pleura, and the meningococcus has been found in some instances[1] in the lungs of those who have had pulmonary inflammations without meningitis. The frequency with which this germ has been found in contacts has greatly varied, Goodwin and von Schelly[2] having found it in the nasal secretions in as many as 10 per cent. of contacts.

The way in which these germs in the nasopharynx reach the meninges and cause cerebrospinal fever has long been discussed. It seems probable, as they are early found in the blood, that the blood stream is the method of conveyance, although the possibility, especially in young children, of their reaching the meninges through the sphenoidal sinuses and first causing perihypophysial inflammation has been long considered and discussed. It is also possible that the blood may spread the infection from the bronchial mucous membrane.

Flexner[3] produced meningitis in monkeys by injecting the infection intraspinally, though injections into the blood by other investigators had not caused the disease.

From these facts meningococcus cerebrospinal meningitis should be made a reportable disease, whether occurring in sporadic or epidemic form, and carriers should be sought, and when discovered, isolated and treated.

SYMPTOMATOLOGY

The disease generally begins suddenly, although there may be such prodromes as aches and pains, especially in the head, with a general feeling of weariness. Soon the headache becomes intense, and most severe in the back of the head. This headache is

1. Jakobitz: Ztschr. f. Hyg. u. Infections krankh., 1907, lvi, 175.
2. Goodwin and von Schelly: Jour. Infect. Dis., 1906, p. 21.
3. Flexner: Jour. Exper. Med., 1907, ix, 142.

accompanied by fever, generally there is vomiting, and there may be early, in fulminating cases, delirium and stupor. Soon there is pain in the back of the neck, with more or less stiffening of the muscles, and tenderness and pain along the spine. Pain in the extremities and body occurs, stiffening of muscles or groups of muscles, and convulsive movements may be present. Deafness is a frequent symptom. Ringing in the ears may be present. The vision may be disturbed. The disease may be so rapid as to cause death within twenty-four hours or even less, but the usual duration is from two to four weeks. Even when the disease is protracted six weeks or more, death may still occur. In prolonged cases a peculiar intermittency or remission of symptoms often occurs.

Herpes frequently occurs on the mouth or face. The frequent occurrence of petechiae has given this disease the name of "spotted fever." Other eruptions, of urticarial type principally, often occur. The spleen is generally enlarged; the appetite is almost absolutely lost; there may be very obstinate constipation, rarely diarrhea. Albuminuria may occur; there may be polyuria or sugar may be found in the urine from irritation of the central nervous system. In some instances there is inability to void the urine, not infrequently due to the administration of opiates for the severe pain.

The height of the fever, while generally indicating the intensity of the disease, does not always do so, as a serious and dangerous attack may be accompanied by but little fever.

There is hardly any part of the body that may not show a complication from this disease. The most frequent complications are, perhaps, pleuritis, pericarditis, pneumonia and arthritis. Inflammations of the parotid glands and of the kidneys are not infrequent. Acute and permanent disturbances of the special senses, due to localized inflammations in different parts of the cerebrum, are not infrequent.

The prognosis has varied enormously in different epidemics, said to be from 20 to 75 per cent. With the serum therapy offered by Flexner and his co-workers this mortality has been very greatly reduced. In young children the mortality is greater than in adults. Even when the symptoms apparently ameliorate, the prognosis should be guarded, as many times a dangerous exacerbation occurs.

DIAGNOSIS

As the success of treatment in this disease depends so much on an early and immediate diagnosis, and the diagnosis is many times so difficult except by expert methods, it is essential, in discussing the therapy of this disease, to insure that the diagnosis is correct. This whole subject has recently been very ably discussed by Du Bois and Neal[4] of New York. These physicians, specializing in the clinical and laboratorial findings in this disease, are able to present valuable statistics. They have examined 992 cerebrospinal fluids, and state that the conditions to be differentiated from meningococcic meningitis are streptococcic and pneumococcic meningitis, that due to the *Streptococcus mucosus capsulatus,* influenza, tuberculous meningitis, poliomyelitis and meningismus, particularly when it occurs in pneumonia.

There is always a leukocytosis in this disease, ranging from 25,000 to 40,000 per cubic millimeter. This leukocytosis is found early, and persists during the activity of the disease. Hess[5] of Chicago found that the relative numbers of neutrophils and lymphocytes varied from time to time in this disease. He found that the eosinophils disappeared early in the infection and did not recur until convalescence was established. As sporadic cerebrospinal meningitis cases are often

4. Du Bois, Phebe L., and Neal, Josephine B.: Summary of Four Years of Clinical and Bacteriologic Experience with Meningitis in New York City, Am. Jour. Dis. Child., January, 1915, p. 1.

5. Hess, Julius H.: Leukocyte Counts in Pneumonia and Cerebrospinal Meningitis, Am. Jour. Dis. Child., January, 1914, p. 1.

difficult to diagnose, and they many times simulate typhoid fever, besides the absence of a Widal reaction, a leukocytosis would preclude typhoid fever. Also, leukocytosis is not present in intermittent fever, and quinin should not be administered in meningitis; hence, an examination of the blood, by showing absence of malarial plasmodia and the presence of a leukocytosis would show the disease not to be malarial fever.

Meningismus is a condition now recognized as occurring not infrequently in serious illnesses, especially in children. It is most frequently seen in pneumonia, gastro-enteritis, and typhoid fever. While the cerebrospinal pressure may be increased in this condition, there may be no germ invasion, and no real inflammation, and though many meningeal symptoms may be present, they may all rapidly improve. The subject of meningismus is also discussed by Du Bois and Neal.[4]

Du Bois[6] states that the rigidity of the neck of infants in epidemic cerebrospinal meningitis is many times so easily overcome as to make one doubt its existence, but when the infant is turned on its side, the head is seen to be markedly retracted. Du Bois and Neal consider that the most important signs of meningitis are stiffness of the neck, variations of regularity in the rate and depth of respiration and MacEwen's and Brudzinski's signs. "MacEwen's sign is that which shows a change in the percussion note over the lateral ventricles due to increased intraventricular pressure;" while "Brudzinski's sign consists in the flexion and eversion of the legs and arms when an attempt is made to flex the head on the chest." Irregularities of the pupils, conjunctivitis, strabismus and nystagmus are all important signs of meningitis. Very young infants may show a bulging fontanel. Conjunctivitis is common in epidemic cerebrospinal menin-

6. Du Bois, Phebe L.: Differential Diagnosis and Treatment of Epidemic Cerebrospinal Meningitis, THE JOURNAL A. M. A., March 15, 1913, p. 820.

gitis, but these investigators find that it is rare in other meningeal conditions. Ptosis of the eyelids and strabismus they find more common in tuberculous meningitis. The so-called Biot's breathing, that is, markedly irregular respirations, both in depth and time, they find present in true meningitis. Cheyne-Stokes respiration is more frequent in tuberculous meningitis, and the pulse is more likely to be irregular in rate and volume in this than in other meningeal conditions. Paralysis they find infrequent in epidemic cerebrospinal meningitis, frequent but transitory in tuberculous meningitis, and always present in real poliomyelitis. The temperature is irregular in cerebrospinal meningitis; generally low in tuberculous meningitis; has a high rise and drops quickly in poliomyelitis.

The petechial eruption of so-called spotted fever they found to occur but infrequently, they having found it only sixteen times in 112 cases. On the other hand, herpes is frequent.

N. P. Barnes[7] of Washington states that he has frequently found, in true cerebrospinal meningitis, that a rash could be caused by directing an electric light and reflector on any portion of the body. He has found this sign absent in other forms of meningitis. He also calls attention to the fact that he has noted dilatation of the pupils produced in all his cases when Kernig's sign was being elicited. Kernig's sign alone was found by Du Bois and Neal not to be important in young children.

Conner and Stillman[8] of New York made a study of the respiratory irregularities of meningitis, and especially of Biot's "meningitic rhythm," which rhythm lacks the regular alternation periods seen in the Cheyne-Stokes type of respiration. These investigators found that Cheyne-Stokes breathing occurred

7. Barnes, N. P.: Interstate Med. Jour., 1913, xx, 9.
8. Conner, Lewis A., and Stillman, Ralph G.: A Pneumographic Study of Respiratory Irregularities in Meningitis, Arch. Int. Med., February, 1912, p. 203.

in 53 per cent. of all cases of meningitis, and in 63 per cent. of all cases in children, and it was much more frequent in tuberculous meningitis. They found that "Biot's breathing, when it occurs, may be regarded as almost pathognomonic of meningitis," while the Cheyne-Stokes type they found to be of no special diagnostic value in adults, but in children, if associated with other suggestive symptoms, it points decidedly toward meningitis.

Of course the most important diagnostic determination is made by spinal puncture. It may be well first to note that Dixon and Halliburton[9] have recently investigated cerebrospinal pressure. After hemorrhage they find a fall in this pressure. They found that variations in cerebrospinal pressure alter the cerebrovenous pressure. They experimented also with various drugs, and found that suprarenal pressor substance affected the cerebrospinal fluid only indirectly, and that the cerebrospinal pressure falls more rapidly than the blood pressure. There is a rise in spinal pressure after the administration of amyl nitrite. They found that deficiency in oxygen or an increase in carbon dioxid in the blood raised the cerebrospinal pressure. In other words, they concluded that there may be constant variations in the amount of the cerebrospinal fluid and consequently the cerebrospinal pressure, due to different conditions of the circulation, but that the amount of change was insignificant compared with that caused by secretory activity of the walls of the cerebrospinal canal.

The Lange gold chlorid reaction of the cerebrospinal fluid of infants and young children as giving evidence of cerebrospinal disease, and especially of syphilis, has been recently tried in over sixty children, by Grulee and Moody[10] of Chicago, who give their technic, but

9. Dixon and Halliburton: Jour. Physiol., 1914, xlviii, 128.
10. Grulee, C. G., and Moody, A. M.: The Lange Gold Chlorid Reaction on the Cerebrospinal Fluid of Infants and Young Children, Am. Jour. Dis. Child., January, 1915, p. 17.

from their findings come to the conclusion that the test is only an aid in diagnosis.

In spinal puncture Du Bois and Neal find that "a clear fluid increased in amount indicates usually one of the following conditions: tuberculous meningitis, poliomyelitis, syphilitic involvement of the central nervous system, brain tumor, or meningismus. A cloudy fluid is the result of a meningitis due to the meningococcus or some of the other pyogenic organisms." As above suggested, in meningismus there is increased cerebrospinal fluid, but it is normal in character. The amount of fluid withdrawn by Du Bois and Neal has varied greatly; they have withdrawn as much as 100 c.c. "In a true meningitis the fluid is inflammatory in character—of the nature of an exudate, and shows an increase in albumin and globulin, and in the number of cells." In meningismus they consider the increased fluid as a transudate. With a cloudy fluid and the finding of the meningococcus, the diagnosis of so-called cerebrospinal fever is positive.

PREVENTION

In the first place, it may be mentioned that rarely it has been noted that the disease has attacked an individual more than once. In the second place, carriers have become more or less immune, but it is self-evident that, having been discovered, although close contact is needed, and though the germ is not sturdy and is readily killed after leaving the body, they must be isolated and treated. Therefore, the persons immediately surrounding a case of meningococcic meningitis should have the secretions of the nose and nasopharynx examined for this germ. It has not been shown just what local treatment of the nose and throat of these individuals is advisable, but antiseptic sprays, swabbings and gargles are certainly indicated.

Vaccinations, with dead meningococci, of children who have been directly exposed to the disease, and of the nurse or other persons, who must care for cerebro-

spinal fever patients would seem to be advisable in preventing the spread of the disease. It has been suggested that a moderate amount of immunity would be sufficient to prevent this particular infection. How long immunity would last is not known. Vaccination with this germ causes a febrile reaction, with leukocytosis. Meningococcus vaccines are now prepared, and can be readily obtained. Sophian and Black[11] have discussed this subject. Meningococcic vaccine has been injected, and antimeningococcic serum has been sprayed into the noses and throats of carriers, with some success. It has not been shown how constantly this treatment is successful.

TREATMENT

It is hardly necessary to urge that the disease should be made reportable, and be reported as soon as the diagnosis is positive. A patient with any primary meningitis should be more or less isolated until the germ of infection has been determined.

Flexner has given us a specific treatment, and the method to be followed in its administration cannot be better described than by once more referring to Du Bois and Neal.

If the fluid taken from the spinal canal is cloudy, they immediately inject antimeningitis serum, warmed to the body temperature, and injected slowly. They consider a syringe as dangerous, and adopt Koplik's gravity method. They state, in general, that the dose for an adult is from 20 to 40 c.c., and for infants and children from 3 to 20 c.c., the amount largely depending on the quantity of fluid withdrawn, and the dose should usually be from 5 to 10 c.c. less than the amount of fluid withdrawn. They state that occasionally in true meningococcic meningitis they have obtained no fluid from the canal in spinal puncture, so-called dry

11. Sophian, Abraham, and Black, J.: Prophylactic Vaccination Against Epidemic Meningitis, The Journal A. M. A., Aug. 17, 1912, p. 527.

tap. In such cases they have injected a small amount of the antiserum, with careful watching of the patient to note changes in pressure as determined by the character of the pulse and respiration. In severe cases they inject the antiserum every twelve hours until there is improvement. In moderate and mild cases they usually repeat the injection once a day for four days. The bacteriologic findings of the fluid withdrawn at the last injection, and the condition of the patient, determines whether the antiserum should be given longer. They state that usually from four to six injections are necessary, but they have given sixteen or more. On successive punctures and injections the patient is turned first on one side and then on the other, which they think insures the emptying of the lateral ventricles in rotation. In other words, a patient who lies on his right side for one puncture will be placed on his left for the next.

A number of times they have seen the patient go immediately into a condition of shock after the injection of the serum, with the respiration shallow, the face pale, and the pulse rapid and thready. They have never, however, seen a patient die in this condition, and if the needle is still in place they withdraw some of the serum. Artificial respiration is resorted to if the breathing has ceased, and hypodermic stimulation of the heart is given. This condition of shock does not occur frequently with the smaller doses that are now administered. The serum they have lately used contains 0.2 per cent. of trikresol, and as they have used trikresol serum over five hundred times in patients of all ages, they do not believe that fatalities are due to the phenol contained. However, on account of objection having been made to trikresol, they are ready to try chloroform as a preservative.

Barnes[12] states that antimeningococcus serum differs from ordinary antiserums in that it is destructive to

12. Barnes: Interstate Med. Jour., 1913, xx, No. 9.

the meningococci, and at the same time neutralizes the endotoxins set free during the destruction of the germs.

If a case of cerebrospinal fever shows a tendency to become chronic, Du Bois and Neal make an autogenous vaccine and give it every four or five days, "in doses of from 250 to 1,000 million" bacteria. They are not convinced of the value of this treatment, but they have not seen it do any harm.

The general treatment of cerebrospinal fever demands the best hygienic surroundings obtainable, and a quiet, cool, darkened room, as in any meningitis. The bowels should be thoroughly moved in the beginning, and then, daily, or every other day, the patient should receive a laxative, if needed.

As the vomiting is reflex, stomach sedatives are of no avail. As the central condition is improved or the patient becomes more stupid, the vomiting will cease. Food in the early stages should not be pushed, as there is great repugnance to it. Plenty of water, and later simple cereal gruels and milk should be the early diet. The subsequent diet should depend on the height of the fever and the ability of the patient to digest. In the stage of convalescence food should be pushed, if it is well digested. Through the acute illness, starches should be given to prevent acidemia. If the pain is sufficient to require sedatives, much food should not be given, as it will not well digest.

A most important symptom of this disease is likely to be pain, and there is no excuse for allowing a patient, because it is a young child, to suffer pain. Morphin or codein represent the most efficient and the safest drugs, the dose, of course, being regulated according to the age of the patient and the effect. Generally it is better to administer a very small dose hypodermically than a large dose by the mouth; the action of the whole dose is obtained, and there is no doubt as to whether or not it is absorbed. Ergot given

in aseptic form, intramuscularly, not only seems to act as a sedative to the nervous system and possibly diminishes congestion, but it certainly prolongs the action of any dose of a narcotic. Less morphin, codein or other narcotic will be required to stop pain and cause rest if ergot is coincidently given. If the blood pressure is low, this is another indication for the administration of ergot. Generally, if the blood pressure is high, ergot should not be given.

Local applications of cold and ice to the head (the hair being cut short) and to the spine, may inhibit the inflammation, and sometimes seem to be of great value. At other times these cold applications seem to increase the pain. This seems to be especially true if the temperature is low. Exactly what these cold applications do to the blood vessels of the parts inflamed is a question that has not been determined. Cold sponging of the body is hardly advisable, as it tends to increase the internal congestion. Theoretically, it would seem more sensible, and practically it is often better to use hot applications, as hot sponging, and even hot baths have been advised, for very young children, to relieve the congestion of the central nervous system.

Painful joints may be wrapped in cotton and kept warm, much as is done in rheumatism. Conjunctivitis should be treated with a simple boric acid wash. The throat and nose should be cleansed with simple saline sprays or mild antiseptic gargles.

There would seem to be no excuse for the administration of quinin, strychnin, caffein, or any other cerebral stimulant. It would also seem inadvisable to administer alcohol in any form. If the blood pressure is high, hot sponging, small doses of nitroglycerin and more brisk catharsis are indicated.

The patient should remain in bed for at least a week after the cessation of the fever, and convalescence should be slow, and the return to activity should be delayed. During convalescence it is well to administer

small doses of sodium iodid, as iodid seems to be efficient in aiding the absorption of exudates. Iron and other tonics may be indicated.

Stiffening of the muscles and joints may require massage, and, if there are any adhesions in the joints, the orthopedist should be consulted as to whether passive movements or forcible breaking up of these adhesions under an anesthetic is advisable.

The frequency with which mental deterioration occurs can only be determined by a long careful study of many cases. Cerebral degenerations and disturbances may develop after many years and yet apparently have been caused by this disease.

The various complications that may occur have already been mentioned, and their treatment would be that usual for the localized inflammation modified by the general condition of the patient from the cerebrospinal fever.

INFLUENZAL MENINGITIS

That the *Bacillus influenzae* can cause meningitis has long been known. It has been well described by Rhea[13] of Montreal. The serum treatment of influenzal meningitis was presented by Wollstein.[14] Dr. Flexner has produced an anti-influenzal serum which may now be used in this disease. The success of such treatment has not yet been determined.

A brief but careful review of recent literature up to about a year ago, on meningitis other than that of cerebrospinal fever, has been presented by Heiman and Feldstein.[15]

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13. Rhea, Lawrence J.: Cerebrospinal Meningitis Due to Bacillus Influenzae, Arch. Int. Med., August, 1911, p. 133.
14. Wollstein: Jour. Exper. Med., 1911, xiv, 73.
15. Heiman, Henry, and Feldstein, Samuel: Résumé of the Recent Literature on Meningitis (not Including Meningococcus Meningitis), Am. Jour. Dis. Child., September, 1913, p. 199.

ACUTE ANTERIOR POLIOMYELITIS (INFANTILE PARALYSIS)

It was not definitely shown, until 1909, that this disease belonged to the infections and was contagious, although it had been long suspected. More or less isolated instances and some slight group attacks had occurred in America for many years, but we have had epidemics only since 1907, caused probably by importations of the germ from Europe, where it has been long endemic. In 1909, Landsteiner and Popper reported that they had caused infantile paralysis in monkeys by inoculating them with a spinal cord emulsion obtained from a child who died from this disease. Noguchi and Flexner later reported that they had been able to cultivate a causative organism of this disease. Recently, Flexner and his co-workers[1] have shown that the contagium is contained in the secretions of the nose, and that undoubtedly there are carriers of this disease. It seems to be demonstrated that the infection or poison reaches the nervous system through the lymph, but probably reaches its point of activity, namely, the spinal cord, by means of the cerebrospinal fluid. In previous experiments Flexner and Amoss[2] have shown that in all probability infection does not reach the individual from the bites of insects, as they were unable to infect monkeys by directly introducing the virus into the blood. This does not preclude the possibility of domestic animals like cats and dogs carrying the contagium and causing infection by way of the nostrils and lymph channels. It has not been shown that flies transmit the contagium, nor that the association with stables has

1. Flexner, Simon, and Amoss, Harold L.: Localization of the Virus and Pathogenesis of Epidemic Poliomyelitis, Jour. Exper. Med., Sept. 1, 1914, p. 249; abstr., THE JOURNAL A. M. A., Sept. 26, 1914, p. 1136.
2. Flexner, S., and Amoss, H. L.: Penetration of Virus of Poliomyelitis from Blood into Cerebrospinal Fluid, Jour. Exper. Med., April, 1914, p. 411; abstr., THE JOURNAL A. M. A., April 25, 1914, p. 1360.

increased the liability of infection, as has been suggested. It does not seem frequent that more than one person in the same household is affected, although such cases occur. However, in epidemics the majority of patients are likely to come from the same general region.

Fraser[3] of New York reports his observations on ninety cases of epidemic poliomyelitis. He found that the age varied from 9 months to 14 years. The majority of cases, especially when it is sporadic, has always occurred in young children under 5 years of age. The death rate is generally low, varying from 4 to 16 per cent., but the paralyses resulting are constant and frequent.

A review of the etiology, bacteriology and pathology of this disease is given by Sever[4] of Boston. Flexner and Lewis' splendid work on this subject is reported in various numbers of THE JOURNAL.[5] They state that the infecting agent in this disease belongs to the class of minute filterable viruses which cannot be demonstrated with certainty by means of the microscope. They also showed that spinal fluid withdrawn on the third day of the infection, before the appearance of paralysis, contains the virus which will cause infections of monkeys. Flexner, Noguchi and Amoss[6] have recently again shown that the minute micro-organism isolated from poliomyelitic tissue is probably an etiologic factor, if not the cause, of epidemic poliomyelitis. Flexner and Lewis[7] also showed that the disease can be transmitted from monkey to

3. Fraser: Am. Jour. Med. Sc., July, 1914, p. 1.
4. Sever: Interstate Med. Jour., 1914, p. 705.
5. Flexner, Simon, and Lewis, Paul A.: The Transmission of Acute Poliomyelitis to Monkeys, THE JOURNAL A. M. A., Nov. 13, 1909, p. 1639; The Nature of the Virus of Epidemic Poliomyelitis, ibid., Dec. 18, 1909, p. 2095; Experimental Epidemic Poliomyelitis in Monkeys, ibid., April 2, 1910, p. 1140; Experimental Poliomyelitis in Monkeys, ibid., May 28, 1910, p. 1780.
6. Flexner, Simon; Noguchi, Hideyo, and Amoss, Harold L.: Concerning Survival and Virulence of the Microorganism Cultivated from Poliomyelitis Tissues, Jour. Exper. Med., January, 1915, p. 91.
7. Flexner, Simon, and Lewis, Paul A.: Epidemic Poliomyelitis in Monkeys, The Activity of the Virus, THE JOURNAL A. M. A., Jan. 1, 1910, p. 45.

monkey. They further showed that the germ or virus resists freezing, and therefore the disease is not stopped by cold weather. They also believe that one attack confers immunity.

Lucas[8] found that monkeys after inoculation showed a lymphocytosis during the acute stages, but a marked and constant leukopenia. The blood at this time also showed an eosinophilia. This disturbance in the white blood count disappeared when the acute stage was over.

PREVENTION

It is quite probable that the so-called "distemper" which at times attacks dogs and may attack horses, is really caused by this same infection. Hence, a dog affected with distemper should be isolated, and no child should be allowed to associate with it. While it has not been shown that flies will carry this disease, in all probability they may transmit the infection by their feet. Consequently, flies should be excluded by proper screens, if possible, from any animal that suffers from distemper, and certainly should be prevented from reaching an individual sick with poliomyelitis.

As early as Feb. 12, 1910, Flexner and Lewis[9] showed that this disease was contagious by means of the secretions of the mucous membrane of the nose especially, and also of the throat, and therefore that every patient should be isolated, and that the disease should be made reportable to the boards of health.

The nurse and the family should understand that the same care must be exercised in destroying the contagium and preventing the contamination of articles and substances by the secretions of the nose and

8. Lucas: Tr. Mass. Med. Soc., June, 1910; the subject is also discussed by Gay, Frederick P., and Lucas, William P.: Anterior Poliomyelitis. Methods of Diagnosis from Spinal Fluid and Blood from Monkeys and in Human Beings, Arch. Int. Med., September, 1910, p. 330.

9. Flexner, Simon, and Lewis, Paul A.: Epidemic Poliomyelitis in Monkeys. A Mode of Spontaneous Infection, The Journal A. M. A., Feb. 12, 1910, p. 535.

throat of a poliomyelitis patient as is so well understood must be taken in diphtheria.

As soon as a case is reported to the board of health, the school board should be informed (as such cases are frequently in children too young to go to school) that they may send home from school the other children of the family, and if there is an epidemic, perhaps the other children of that tenement. The incubation period is said to vary, and may be as long as ten days, but to be safe from causing infection in others, such children should remain out of school for two weeks.

EARLY SYMPTOMS

Although a patient who is old enough may complain of headache and pains, especially in the epidemic form of the disease, still, in this as well as in the sporadic form, the onset may be so rapid that a child well the night before may be found with high fever and even with paralysis in the morning. Pain is referred generally to the muscles of the back and legs, and later to the muscles of the arms. The temperature in serious cases may be high, but the ordinary range of rectal temperature was found by Fraser to be from 101 to 103. The pulse-rate is high, and is generally over 120. While pain may keep the little patient awake, and there may be a great amount of irritability and restlessness, drowsiness and heaviness was noted by Fraser in half of his cases, although there were often twitchings and jerkings during sleep. In two-thirds of his cases he found stiffness of the neck and back, which is so characteristic of cerebrospinal meningitis. The greatest tenderness is found generally in the extremities. Although this might last but one or two days, it sometimes persists for three or four weeks. The tendon reflexes are found generally absent.

Although, as just stated, paralysis may occur almost coincident with the illness in sporadic cases, in epidemic cases paralysis seems to develop most fre-

quently on the third or fourth day. The acute illness lasts from one week to ten days. A large number of Fraser's cases showed some slight facial paralysis. If the respiratory muscles were affected, the prognosis was dire. There may be paralytic interference with urination, and defecation may be difficult from inability of the abdominal muscles to act.

It should be remembered that many abortive forms of this disease probably occur without any paralysis, and many times without a diagnosis, and such cases may doubtless spread infection. Koplik,[10] in reviewing an epidemic of 1,200 cases, states that many atypical forms occur.

As to the extremities, one or both arms may be paralyzed, or one arm and one leg, or both legs, or there may be crossed arm and leg paralysis. The arm paralysis is not often complete, and the recovery is more rapid. Complete loss of response to faradism means a bad prognosis as to recovery, and atrophy will rapidly occur. If response to faradism is not completely lost, the outlook, with proper care and treatment, is good. The rapidity of recovery from paralysis, and the number that completely recover vary with the different epidemics; but the number that completely recover is lamentably small. More scientific treatment by nerve and orthopedic experts will doubtless make this percentage of complete recoveries much greater.

TREATMENT

A. The Acute Stage.—The same care in isolation, and of the secretions of the nose and throat, to prevent possible infection of others or contamination of articles, should be carried out as has been described for the other infectious diseases. Flies and all domestic animals must positively be excluded from the sick-room. As soon as the diagnosis is positive, the disease should be reported to the board of health,

10. Koplik, H.: An Epidemic of Acute Poliomyelitis, Arch. Pediat., May, 1909, p. 321.

whether or not it is a reportable disease in the community.

Flexner[11] has shown that bedbugs may become infected with this disease. Whether or not they can transmit the disease to a human being by their bites has not been shown. Mosquitoes and lice have not yet been shown to be guilty of carrying the infection, but they, as well as bedbugs and fleas, are not needed in the treatment of this disease.

As Flexner states that the virus is eliminated by the intestines as well as by the nose and throat, all movements of the bowels during the course of the disease, and perhaps for some little time after the acute stage is over, should be as thoroughly disinfected as they are in typhoid fever. Lucas and Osgood[12] found the virus in the nasal secretions of a human being four months after the acute stage of an attack of poliomyelitis. They also found the virus in the nasopharynx of persons who were in attendance on a patient ill with the disease, and in the nasopharynx of a patient who had had the disease 204 days after the acute infection. Kling,[13] however, thinks that the virus soon loses its virulence, and that quarantine need not be continued for more than two weeks. It cannot yet be decided just how long quarantine should be continued, but two weeks should be the under limit, and better, three weeks. That more of the attendants or associates of a patient sick with poliomyelitis do not contract the disease may be because they are insusceptible, or they may have become immune from some previous abortive attack.

There has not yet been produced an antiserum, although it is most sincerely hoped that Flexner and his co-workers will be able to add such a serum to

11. Flexner, Simon: The Mode of Infection in Epidemic Poliomyelitis, The Journal A. M. A., Oct. 12, 1912, p. 1371.
12. Lucas, William P., and Osgood, Robert B.: Transmission Experiments with the Virus of Poliomyelitis, The Journal A. M. A., May 24, 1913, p. 1611.
13. Kling, Carl: The Etiology of Epidemic Poliomyelitis, Wien. klin. Wchnschr., Jan. 10, 1913, p. 41.

the list of their splendid achievements. With our better knowledge of the action of hexamethylenamin, we cannot expect germicidal activity in the cerebrospinal fluid, which is alkaline. It has been shown that this drug has no germicidal activities, except in an acid medium, and, therefore, it is of special value only in infections of the pelvis of the kidney, ureters, bladder and urethra, and then only when the urine is acid. Hence, when the disease has started, there is no known medical method of aborting it, although mild infections may abort without paralysis.

The treatment in this stage of the disease is to relieve cerebral and spinal congestion and remove all possible toxins that may be absorbed from the intestinal canal by free but gentle catharsis. Calomel, in one sufficient dose, associated with cascara, aloin or rhubarb, as deemed advisable, is always a good method of treatment. Castor oil is another, or at times a quickly acting saline cathartic may be advisable. Subsequently the bowels should be moved as frequently as the diet and the condition of the intestines seem to require. A child that is not taking much food for the first two or three days after the first cleaning out of the intestines need not necessarily be bothered with a laxative every day during this first stage of the disease. As soon as paralysis begins, it may be difficult to cause the bowels to move, and a simple glycerin suppository or a small enema may be needed.

The child must not be allowed to forget to urinate, as some loss of normal bladder irritability may allow urine to be retained and distention of the bladder to occur. Therefore, the child should be encouraged to urinate at about four-hour intervals. Of course, if the urine cannot be passed, it must be drawn.

Generally the fever is not high. If it is high, two or three small doses of acetanilid may be administered; or sponging the body with warm water is advisable. General cold sponging or general cold applications are inadvisable, as tending to cause increased congestion

of the central nervous system. The value of an ice cap as a reducer of temperature is doubtful, and it is likely to cause the child to become more restless. The value of a spinal ice bag is also doubtful, as many times these cold applications cause an increase of pain.

Pain must be stopped in a child as well as in an adult; this fact is often forgotten. The physician allows a child to suffer because he dislikes to give strong narcotics, when an adult would demand something to stop his pain. If there is high fever and a few doses of acetanilid have been given, this may prevent some of the pain, but pain is most safely combated by small doses of morphin, codein, or opium in some form. Perhaps there is no better method of giving this narcotic drug to a child than by means of the deodorized tincture of opium. The dose may be, even to a young child, one drop every hour until the child is sleeping or is quiet. If the child is very young, of course the dose should be less, and for a child 10 years of age the dose should be larger. If the brain is so affected that the child is stupid, pain is not much felt, and narcotics will not be needed. Unless the child is excessively nervous, restless, sleepless, and twitching and jerking about the bed, such cerebrospinal depressants as chloral and bromid are not indicated, as one can but feel they might tend to increase the muscle debility and paralysis that must follow the acute stage of the disease. It seems safer and more rational to give for this condition opium or one of its alkaloids in a dose sufficient to cause quiet and rest.

In this disease, as in all forms of meningitis, the bedroom should be quiet and removed as far as possible from all noise and disturbance. The child should not be unnecessarily spoken to, and there should be frequent darkening of the room in order that the patient may get all the rest possible.

During the active stage food should not be pushed. Part of the diet should be milk, and the rest of it should be cereal gruels. The diet should not be

wholly milk, for in this as in all acute diseases the possibility of acidemic conditions occurring should not be forgotten, and starches should always be given in the form most acceptable to the patient. The first day or two the child will be thirsty, and should be allowed all the water it desires. As soon as the fever diminishes or ceases, nutrition should be pushed, and the child should be encouraged to eat so that the general strength may be recovered as rapidly as possible. If at this time the tongue is coated, the digestion poor and the appetite insufficient, it may be because gastric acidity is insufficient, and a few drops (not more than five) of dilute hydrochloric acid, in water, after meals, may aid in overcoming these conditions. Or perhaps still better is the tincture of iron chlorid in a dose of not more than three or four drops, in a little fresh lemonade or orangeade.

B. Local Treatment.—Fixation of the painful extremities and of the back, in the most restful position, with the aid of cushions and pillows, is important during the acute stage. As there is no special inflammation in any joint or muscle, cold or ice to a painful region is not indicated. Dry warmth may cause a lessening of the pain and is often of value. If the limbs affected become cold from disturbed circulation, they should be surrounded with cotton or covered with flannel. Restriction by bandages is inadvisable.

The pathologic lesions of the disease may be studied in an article by Flexner, Clark and Amoss.[14] Several years ago Lovett and Lucas[15] studied 635 cases of infantile paralysis, and came to the conclusion that paralysis of one leg was nearly four times more frequent than paralysis of both legs, and paralysis of an arm and leg of one side was more common than was a crossed paralysis. The internal muscles

14. Flexner, S., Clark, P. F., and Amoss, L.: Epidemiology of Poliomyelitis, Jour. Exper. Med., Feb. 1, 1914.

15. Lovett, Robert W., and Lucas, W. P.: Infantile Paralysis. A Study of 635 Cases with Especial Reference to Treatment, THE JOURNAL A. M. A., Nov. 14, 1908, p. 1677.

of an extremity were more frequently affected than the external, and the anterior than the posterior. The most common muscle to be affected in the leg they found to be the quadriceps; the next in frequency was the tibialis anticus and anterior muscles of the lower leg. If the hamstring muscles were affected it was more often the internal than the external, and the sartorius muscle they found frequently not to be affected even when the quadriceps was. They found the internal rotators of the thigh more frequently affected than the external rotators, and the adductors more frequently than the abductors. The short toe flexors they found the least likely to be affected. In the upper extremity, the arm is more frequently affected than the forearm, and the deltoid the muscle most affected, although the biceps, triceps and scapular muscles may also be affected.

During the first stages of the paralysis great care must be taken in watching the position of the limbs, especially the legs, to prevent contractions caused by the pulling of the unaffected muscles. Massage is soon valuable, but must be very gentle. Proper massage will not only increase the nutrition of the affected muscles, but cause relaxation of spasm of the unaffected muscles. It may be necessary to devise some apparatus to keep the leg or foot from becoming deformed. For this purpose various splints, or wooden or wire troughs properly padded with cotton may be used. Gibney and Wallace[16] urge that the legs should be kept straight or in slight flexion at the knees and in line with the body, while the feet should be kept at right angles with the legs.

The value of having the child, as early as possible, make slight voluntary efforts with the paralyzed muscles is excessively important. All neurologists and orthopedists now believe that one voluntary contraction of a muscle is of very much greater value than

16. Gibney, V. P., and Wallace, Charlton: The Recent Epidemic of Poliomyelitis, The Journal A. M. A., Dec. 21, 1907, p. 2082.

many passive activities of a muscle or contractions caused by electricity or other irritant.

Some writers believe that counterirritants applied to the spine, such as cautery treatments, are of value in hastening the stage of resolution of this disease. While they may be of value, consideration must always be given to the disturbance that it will cause the child who has suffered enough pain, and who already has difficulty in finding comfortable positions in bed.

C. Paralysis.—When the circulation is poor in an extremity, the local application of heat in any form, and perhaps by baking, is of value. As soon as it is believed that all active inflammation in the spinal cord has ceased, electricity should be begun, and Jones[17] believes that electricity should not be used until from three to eight weeks from the beginning of the infection. Galvanism should then be used on the nerve trunks, gently and not too strong, while the muscles are caused to contract by faradism as long as they react to that current. If they do not react to the faradic current, the galvanic current should be used to cause contraction by making and breaking. The rapidity of the making and breaking galvanic current should not be too great, nor should any kind of muscle stimulation be continued too long at any one sitting; in fact, at first only a few contractions should be caused.

Voluntary training directed by a skilled orthopedist, and the application of any splints or apparatus that may be necessary to prevent deformities and atrophies should soon be inaugurated, as Taylor[18] and many others believe that massage and electricity are very ineffective in causing recovery of muscles paralyzed by poliomyelitis. All physicians and surgeons urge

17. Jones, R.: Infantile Paralysis (Acute Anterior Poliomyelitis). Its Early Treatment and Surgical Means for Alleviation of Deformities, Brit. Med. Jour., May 30, 1914; abstr., THE JOURNAL A. M. A., July 4, 1914, p. 63.

18. Taylor, H. L.: The Management of Poliomyelitis and Its Sequelae, Med. Rec., New York, Oct. 15, 1910; abstr., THE JOURNAL A. M. A., Oct. 29, 1910, p. 1590.

that the greatest improvement is caused by plenty of rest in bed, graded exercise, warm baths, good food and fresh air. In other words, the better the nutrition the greater the improvement in the paralyzed muscles. Muscles may even recover after a year or more of paralysis when treated by a skilled orthopedist. It should be emphasized that rough, harsh massage and misdirected use of electricity may do serious harm to the paralyzed and contracted muscles. In a word, the general practitioner should as quickly seek the aid of the orthopedist in treating the paralysis of this disease as he would seek a skilled aurist in an internal or middle-ear inflammation.

Surgical repair of deformities that cannot be corrected by apparatus or muscle training has now reached a stage never equaled before, and tendon transplantation and other orthopedic operative measures cannot too soon be considered when improvement ceases to occur in a limb affected with paralysis from poliomyelitis. A recent discussion of this subject is presented by Moore[19] of Philadelphia.

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19. Moore, J. W.: The Surgical Treatment of Infantile Paralysis, New York Med. Jour., Aug. 29, 1914, p. 404.

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